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ASSESSMENT OF GREEN BUILDING ISSUES AND RECOMMENDATIONS FOR DEVELOPING A BUILDINGS RATING AND CERTIFICATION SCHEME IN GEORGIA

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DISCLAIMER

The author's views expressed in this publication do not necessarily reflect the views of the United States Agency for International Development or the United States Government.

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ACRONYMS

AP	Accredited Professional
BCA	Building and Construction Authority
BEC	baseline energy consumption
BRE	Building Research Establishment (UK)
BREEAM	Building Research Establishment Environmental Assessment Methodology
CASBEE	Comprehensive Assessment System for Built Environment Efficiency
CENN	Caucasus Environmental NGO Network
CIS	Commonwealth of Independent States
CO_2	carbon dioxide
COP	Chief of Party
DCLG	Department for Communities and Local Government (UK)
DCOP	Deputy Chief of Party
DGNB	Deutsches Gutesiegelnachhaltiges Bauen (German certification for sustainable construction)
DH	district heating
DHW	domestic hot water
DIFNI	German Institute for Sustainable Real Estate
EBRD	European Bank for Reconstruction and Development
EC-LEDS	Enhancing Capacity for Low Emissions Development Strategies
EE	energy efficiency
EIA	environmental impact assessment
EPBD	Energy Performance of Buildings Directive (European Union)
EPC	Energy Performance Certificate
EU	European Union
GB	green building
GBC	Green Building Council
GBC-G	Green Building Council of Georgia
GBCI	Green Building Certification Institute
GGBRCB	Georgian Green Buildings Rating and Certification Board
GHG	greenhouse gas
GOG	Government of Georgia
GREA	Real Estate Association of Georgia
GWP	global warming potential
HOA	homeowners' association
HVAC	heating, ventilation, and air conditioning
IT	Information technology
LCA	life-cycle assessment
LEED	Leadership in Energy and Environmental Design
LEED AP	LEED – Accredited Professional
MCA	Millennium Challenge Account
MCC	Millennium Challenge Corporation
MRV	monitoring, reporting and verification
NCM	National Calculation Methodology
NGO	non-governmental organization
NSO	national scheme operator
ODP	ozone depletion potential
POCP	photochemical ozone creation potential
PVC	poly-vinyl chloride
RET	renewable energy technology
RIBA	Royal Institute of British Architecture
SADP-C	Sustainable Development and Policy Centre (SADP- Centre)
SBEM	Simplified Building Energy Model
SEAP	Sustainable Energy Action Plan

SMEs	small- and medium-sized enterprises
SPV	solar photovoltaic
UK	United Kingdom
UKAS	United Kingdom Accreditation Service
UNEP	United Nations Environment Programme
U.S.	United States
USGBC	United States Green Building Council
USAID	United States Agency for International Development
VOC	volatile organic compound

EXECUTIVE SUMMARY

The Assessment of Green Building issues and recommendations for Developing a Buildings Rating and Certification Scheme in Georgia (Green Building Assessment) report was prepared for Component 2: Green Building Rating and Certification System of the EC-LEDS program. Component 2 aims to stimulate efficient energy use and reduced emissions from residential, commercial, and public buildings through the development of an effective voluntary system for rating and certifying green buildings in Georgia.

The Green Building Assessment report includes the following sections:

1. Review of existing green building rating and certification schemes
2. Recommendations for developing a green building (GB) rating and certification scheme in Georgia
3. Review of current construction practices and available green buildings construction materials in Georgia
4. Approach to developing a Monitoring, Reporting and Verification (MRV) framework

Section one of the report provides a short overview of the six most widespread Green Building certification and rating systems of the world, i.e. BREEAM: Building Research Establishment Environmental Assessment Methodology (United Kingdom), LEED: Leadership in Energy and Environmental Design (United States), Green Star (Australia), DGNB: Deutsches Gutesiegelnachhaltiges Bauen (German Certification for Sustainable Construction) (Germany), CASBEE: Comprehensive Assessment System for Built Environment Efficiency (Japan) and Building and Construction Authority (BCA) Green Mark (Singapore). These systems have many common features, namely all of them consider energy consumption in the building and energy efficiency as one of the top priorities. The next most common features are Indoor Environmental Quality (covered by CASBEE, Green Star, LEED & DGNB) and emissions/pollution (covered by BREEAM, Green Star, LEED and DGNB). GB Certification and Rating Systems use different approaches for new construction versus refurbishment, and some include different approaches for schools, healthcare institutions, public buildings, commercial Interiors, etc.

Section two of the report reviews building construction activities in Georgia from ancient times to current practices. It divides construction practices in Georgia into three different historical periods: the Pre-Soviet (from 2nd and 3rd millennia BC to 1921) construction era, the Soviet (1921-1990) construction era and the post-Soviet (1991-Present) construction era. The Soviet construction era is further divided into: Early Soviet Era (1921-1937), Stalin Era (1937-1956) and Post-Stalin Era (1956-1990). General construction practices of each era are described, as well as use of building materials and their energy efficiency properties, thermal performance of external walls, fenestration or glazing and heating systems of the building stock, and the possibility of implementing energy efficiency and renewable energy technologies in these buildings.

The pre-Soviet construction era was very different from the others as it mostly used half-cave concepts and widely used passive design. During the Early Soviet Era of construction, no unified building construction codes or laws existed, and buildings were designed individually. Buildings of this era were mainly low-rise structures and were built mainly to provide the basic requirement of shelter. These buildings always included basements to serve strategic (safety and security) purposes, serving as shelters during military attacks. During the Stalin era of construction, a unified building construction code was in operation. Many buildings of this era thus had similar appearances, underlining the control of the Soviet Union. The buildings were mainly constructed for working class families and comprised one or two bedroom apartments in blocks of 5-9 floors. During the Post-Stalin Era of construction, buildings were low-cost and minimalistic, as a result of the industrialization of the country and demand for a greater number of inexpensive buildings. Also, a standard design and prefabricated building envelopes were used for thousands of houses. The main environmental features taken into consideration in designing and constructing buildings of the Stalin Era were thermal properties of the buildings, indoor air quality, and use of locally available construction materials.

The collapse of the Soviet Union marked the advent of the Post-Soviet building construction era in Georgia. The main effect on the building sector was that building and environmental regulations were no longer enforced. Environmental and sustainability parameters were no longer given high priority in the design and construction of buildings. Greater importance was placed on the outer appearance of buildings to enhance salability, rather than on the technical performance, including energy efficiency, of the structure. As a result, some buildings constructed in this era become too cold during the winter and need more energy to keep their occupants warm and comfortable. Other buildings suffer from damp conditions and dry rot. The majority of buildings constructed during this era are designed as reinforced concrete frame and slabs. Thin cement and sand blocks are used to construct internal and external walls.

In Section three, recommendations for establishment of a GB certification and rating system for Georgia are provided. Recommendations include using existing BREEAM and LEED systems initially, and creating a Georgia specific rating system. The author recommends that the first version of the Georgian green building rating and certification scheme focus on existing buildings (residential, non-residential, and public buildings) and on certifying to an energy performance code (EPC). He suggests using the operational methodology of the existing building EPC certification scheme presently in operation in the UK, Northern Ireland, and the Republic of Ireland.

This section ends with recommended steps for creating a GB rating and certification scheme in Georgia including recommendations for developing a register of individual and professional groups of GB stakeholders in the country, creation of a Georgian Green Buildings Rating and Certification Board (GGBRCB) and its temporary executive bureau, developing detailed terms of reference and expected deliverables for the temporary executive bureau of the GGBRCB, and engaging a lawyer and registering the GGBRCB as a corporate organization.

Section four of the report suggests a framework approach to developing a Monitoring, Reporting and Verification (MRV) Plan. It also includes use of a specially developed computer software package as the analytical tool in the Georgian buildings rating and certification scheme and development of a life-cycle assessment tool to be used by the GGBRCB to assess buildings' compliance with the selected GB parameters which are included in the different versions of the Georgian green buildings rating and certification scheme. The MRV plan includes adoption of a management structure for the GGBRCB, which is proposed as the main body responsible for verifying energy savings and quantifying GHG emissions reductions, as well as all other operations for the buildings rating and certification scheme in Georgia. A proposed management structure for the GGBRCB that includes three levels was proposed: The Council, the GB Management Unit and Accreditation and Certification Organ, and the Regulation and Standards Organ. The report provides recommendations for the duties and operation of the GGBRCB.

SECTION ONE: REVIEW OF EXISTING BUILDING RATING AND CERTIFICATION SCHEMES

1.0 INTRODUCTION

This report provides an assessment of green building issues and recommendations for developing a green buildings rating and certification scheme in Georgia. The report contains a review of existing relevant green buildings rating and certification schemes, a description of current construction practices and available green buildings construction materials in Georgia, recommendations for developing a green building rating and certification scheme for Georgia, and recommendations for developing a monitoring, reporting, and verification (MRV) framework.

This report was prepared as a deliverable for the green building component (Component 2) of the United States Agency for International Development (USAID) funded Enhancing Capacity for Low Emission Development Strategies (EC-LEDS) - Clean Energy Program in Georgia. Component 2 aims to stimulate efficient energy use and reduced emissions from residential, commercial, and public buildings through the development of an effective voluntary system for rating and certifying green buildings in Georgia.

This report contains the following sections:

1) Review of existing green buildings rating and certification schemes
2) Recommendations for developing a green buildings rating and certification scheme in Georgia
3) Review of current construction practices and available green buildings construction materials in Georgia
4) Approach to developing an MRV framework

1.1 Overview of Low Energy vs. "Green" Buildings

This report addresses two categories of buildings in Georgia: residential and non-residential. Residential buildings are buildings that are designed and constructed specifically for dwellings and include detached bungalows; semi-detached buildings; terraced buildings; and low- or high-rise buildings, such as apartments and condominiums. Non-residential buildings are those that are not designed for dwelling purposes, including: office blocks, hotels, prisons, industrial/factory buildings, schools, and hospitals.

In urban centers, there is an increase in mixed-use buildings, with lower floors used as commercial space and upper floors used as dwellings. Factors that govern conventional construction of both types of buildings include: the potential use of the building, available financial resources, requirements for payback periods, and the building owner's preferences. Additional factors increasingly being considered include the environmental impact of buildings and the application of sustainable construction principles. The construction of sustainable or "green" buildings incorporates both the increased use of sustainable and environmentally friendly materials, and the application of construction processes which present the least impact on the environment.

Green buildings enhance resource efficiency throughout the building's entire life cycle. Table 1 lists the common phases of a building's life.

	Building Life Cycle Phase	Explanation
1.	Design phase	Also referred to as the building conception phase. This is the period when the architects and the team of building engineers meet and decide how the building will look, how it will be constructed, and how it will be commissioned and put to its intended use.
2.	Construction phase	During this phase, the building materials and construction equipment are transported to the site and the building is assembled.
3.	Operational phase	This phase refers to the period when the building is fully constructed and put to its intended use.
4.	Maintenance	Maintenance refers to major or minor repairs carried out on the building from the time it is commissioned until the time it is decommissioned.
5.	Renovation/Retrofits	These are major changes to the internal layout of the building which may occur as a result of change of occupancy.
6.	Demolition phase	This last phase occurs when the building is taken out of use and demolished.

Table 1: Phases of a Building's Life Cycle

Green building (GB) practices can be implemented during the entire building cycle. Constructing low energy buildings -- focusing on the implementation of energy efficiency (EE) and renewable energy technology (RET) solutions -- improves the "green" credentials of the buildings, particularly during their operational stage.

The table below presents typical parameters considered in EE and RET solutions and green buildings.

Low Energy Buildings (Effective during the building's operation)	**Green Buildings** (Effective throughout the building's life cycle)
1. Passive design	1. Management
2. Improved R-values	2. Site sustainability
3. Improved U-values	3. Indoor environmental quality
4. Upgrading of lights	4. Quality of services
5. Upgrading of space heating	5. Outdoor environment
6. Upgrading of air-conditioning	6. Energy
7. Improved domestic hot water systems	7. Materials
8. Efficient elevators	8. Sourcing of materials
9. Introduction of RET solutions	9. Off-site environment
	10. Transportation
	11. Water
	12. Land use
	13. Emissions and pollution
	14. Innovation
	15. Health and well-being

Table 2: Low Energy vs. Green Building Parameters

1.2 Overview of Green Building Parameters

The green buildings rating and certification parameters displayed in Table 2 cover the entire life cycle of a building, from the initial design stage to decommissioning/demolition. They include measurement parameters (identifying variables and collecting relevant data), assessment parameters (evaluating performance against criteria), and parameters used to promote sustainability by changing practices and procedures (BRE, 2004; Therivel, 2004).

Implementing sustainability parameters helps optimize building performance and minimize environmental impact. It also provides a measure of a building's effect on the environment and helps set credible standards by which buildings can be objectively analyzed. For more detailed explanations on how GB parameters are used in rating and certification schemes, see Reed R, et al. (2009).

1.2.1 Management

GB rating and certification schemes use sustainability parameters and place high value on the utilization of trained professionals in the different stages of a building's life cycle. For example:

(a.) During the design stage: The inclusion in the design team of an energy or building services engineer with accredited credentials, such as Leadership in Energy and Environmental Design Accredited Professionals (LEED APs) or Building Research Establishment Environmental Assessment Methodology Accredited Professionals (BREEAM APs), earn the building higher scores in the GB rating and certification scheme (as opposed to a design team with no GB accredited personnel); and

(b.) During the occupancy stage: Buildings with managers who have GB credentials (e.g., LEED AP or BREEAM AP) also receive higher scores than buildings whose managers do not have verifiable GB accreditation credentials.

It would be beneficial to develop an Accredited Professional (AP) certification program for professionals who would then be able to design, manager, and assess and certify buildings under the Georgian GB rating and certification scheme.

1.2.2 Site Sustainability

This GB parameter analyzes the disturbances caused to the building site and its surroundings, such as access routes to the site, during the construction and occupancy phases of the building. During the construction phase, disturbances caused to terrestrial and aquatic habitats (if applicable) are also assessed. Depending on the use of the building, aspects such as noise levels at the location may be considered and assessed during the occupancy phase.

1.2.3 Indoor Environmental Quality

This GB parameter measures the quality of the built environment as it relates to comfort, health, and productivity of the occupants of the building. Indoor environmental quality is enhanced if the thermal mass of the external walls is suitable for the building's climatic zone.

Other aspects considered and assessed include measurement of the levels of:

(a.) Volatile organic compounds (VOCs): VOC levels depend on the type and quality of finishing products used in the building's interior. For example, a building with an interior painted with inorganic paint would score lower than a building with an interior lined with naturally occurring materials, such as marble or slate.

(b.) Microbial contaminants (microbes): The level of microbes present relates to the ventilation system installed in the building. The ventilation system controls the building's air flow.

(c.) In some instances, ventilation requirements can be satisfied by the application of innovative and passive design techniques that appropriately orient the building relative to prevailing winds.

(d.) Dampness and condensation: These levels are related to the thickness of the external walls, the type of fenestration installed, and the ventilation system in the building. Buildings with suitable thermal masses (for the external walls) tend to have lower condensation levels.

(e.) Humidity in the building: This is also related to air-flow within the building.

1.2.4 Quality of Services

This GB parameter assesses and rates buildings used for similar occupations in different locations, and determines the quality of service delivery from each site.

1.2.5 Outdoor Environment

This parameter is related to Site Sustainability but focuses on the assessment of outdoor environmental quality during construction, as well as during occupancy. It focuses on air quality and fuel leaks to the soil as a result of fossil fuel consumed by equipment deployed at construction sites. If the site is located near flowing or standing bodies of water, this parameter also analyzes the impact of the construction on water quality.

During the building's occupancy, this parameter is also used to assess the effects of occupancy on air, terrestrial and aquatic quality.

1.2.6 Energy

Green buildings generally include measures to reduce energy consumption. With regard to energy in green buildings, the following are considered:

(a.) The embodied energy required to extract, process, transport and install building materials at the construction sites;
(b.) On-site energy use during the construction process; and
(c.) Operating energy used to provide services such as lighting, heating, and power for the building from when it is occupied until it is decommissioned.

1.2.7 Materials

A building's score on any green building rating and certification scheme relates to the use of green building materials. "Green" construction materials vary and may include: lumber from third-party certified forests, rapidly-growing plant materials such as bamboo or straw, recycled stone, and compressed earth blocks. In more complex green building and certification schemes like LEED, assessment for the green construction materials parameter may include the energy used in transporting the materials to the construction site and in processing the materials.

1.2.8 Sourcing of Materials

This parameter considers the source of green construction materials – often through the use of third-party certification schemes. For example, wood obtained from certified forests would be rated as "greener" than non-certified wood. The certification scheme ensures greater sustainability for the forest where the wood is sourced.

Rating schemes address many different green construction materials, including:

(a.) Double- and triple-glazed windows and doors with PVC frames;
(b.) Recycling schemes for aggregates;
(c.) Recycled metals for construction of buildings; and
(d.) Building services such as domestic hot water units, heating, ventilation and air conditioning (HVAC) units.

The application of this parameter in the Georgian GB rating and certification scheme will help to develop third-party certification schemes for various materials in Georgia.

1.2.9 Off-site Environment

This GB parameter assesses how the construction process and occupancy activities impact neighboring structures. It also assesses the impact of the construction process on public utilities such as water and gas distribution, as well as on the source of materials.

1.2.10 Transportation

This GB parameter assesses the impact of transporting construction materials to the site and removing construction waste from the site. Also considered is the accessibility of public transportation to residents during the operational stage of the building.

1.2.11 Water

Aspects of water efficiency considered in rating and certification schemes include:

(a.) Embodied water used in the manufacturing of blocks (especially for the core and shell construction mode which is common in Georgia);
(b.) On-site water use during the construction phase of the building; and
(c.) Efficiency of water use during the occupancy phase of the building.

The more a building is designed to reduce its dependence on public water during the construction phase and, most importantly, during its operational phase, the higher it is rated by any green building rating and certification scheme. Water may be conserved during the operational phase of buildings by designing and installing:

a) Rainwater harvesting facilities;
b) Dual plumbing that recycles grey water for the flushing of toilets and washing of cars; and
c) Water conserving fixtures, such as ultra-low flush toilets and low-flow shower heads, which may minimize wastewater.

1.2.12 Land Use

This GB parameter assesses how effectively the land is utilized for the project. Some aspects considered include use of the shortest route for access to the construction site, stacking construction sheds rather than spreading them over wide areas, adequate compensation to indigenous land owners (if applicable), and respecting land boundaries relative to geographic landmarks like flowing or standing bodies of water.

1.2.13 Emissions and Pollution

This GB parameter assesses the level of emissions of greenhouse gases (GHGs) and other pollutants during the construction and operational phases of the building.

1.2.14 Innovation

This parameter assesses the types of new technologies used in the building. These include:

(a.) Innovative engineering concepts such as rainwater harvesting and grey water recycling;
(b.) New construction technologies that reduce environmental impacts during the construction phase of the building; and
(c.) New energy-efficient building systems installed in the building and used during the operational phase of the building.

1.2.15 Health and Well-being

This parameter is an assessment of how the occupants feel while occupying (living or working in) the building._As presented in Table 3, the existing GB rating and certification schemes consider different parameters in the rating and certification process. The GB parameters used in certification schemes in different locations take into account the climatic, geophysical, geological, and environmental peculiarities of the region where such schemes are implemented. Therefore, the parameters selected for inclusion in the proposed Georgian green building rating and certification scheme should take into consideration the Georgian environmental, climatic, geological and geophysical realities.

1.3 Greenhouse Gas Emissions from Buildings in Georgia

Buildings in Georgia are responsible for roughly 40% of the country's annual carbon dioxide (CO_2) emissions. According to the Tbilisi City Planning Unit, since both residential and non-residential construction continues at a rate of about 20% per annum, the country's key goals should include minimizing the environmental impacts of both building operations (for existing buildings) and buildings construction (for new buildings). This can be done by:

(1.) Introducing energy efficiency, RET solutions, and urban sustainability concepts for the stock of existing buildings; and
(2.) Applying sustainable construction (green buildings) concepts in the construction of new buildings.

Examples of EE options that are suitable for implementation in existing residential and non-residential buildings in Georgia include:

(a.) Replacement of inefficient lights with energy efficient lighting units;
(b.) Addition of wall insulation to external walls;
(c.) Insulation of roofs (ceilings and attic);
(d.) Insulation of floors and basements;
(e.) Introduction of double glazing for all windows;
(f.) Replacement of metal panel doors with PVC doors;
(g.) Replacement of inefficient space heating units with energy efficient space heating units; and
(h.) Reintroduction of district heating systems powered by natural gas for communities of high-rise buildings.

Examples of RET solutions suitable for implementation in existing buildings in Georgia include:

(a.) Installation of solar photovoltaic (SPV) cells on the roofs of existing buildings, to generate green electricity for lighting in these buildings;

(b.) Installation of solar thermal units on the roofs of existing buildings, to generate hot water for use in space heating in these buildings; and
(c.) Implementation of micro hydro-electricity for communities of high-rise buildings existing less than two kilometers from a flowing river.

Examples of urban sustainability options suitable for implementation in existing buildings in Georgia include the introduction of:

(a.) Urban agriculture/horticulture schemes on the roofs and walls of existing buildings; and
(b.) Domestic waste separation and recycling.

Implementing all or a combination of these schemes would help reduce carbon emissions associated with the operation of buildings.

1.4 Quantification of Sustainability Parameters for Both Construction Materials and Construction Processes

The methodology used to quantify the sustainability of a building consists of three main steps. The first step is carried out during the design stage of the building and assesses the suitability of a site for the particular type of building and occupancy. The following GB parameters are normally taken into consideration during this process:

(a.) Site Sustainability: How the construction process and the operational stage would create the least environmental impact for the type of building;

(b.) Quality of Service: Compared to buildings with similar occupancy, how the building under review would present optimum service;

(c.) Transportation: How to minimize the environmental impact of the construction phase and the occupancy stage of the building, with regard to GHG emissions and other pollutants;

(d.) Land Use: Assessment of how effectively the land has been utilized with regard to minimizing environmental impacts on geophysical features such as groundwater, nearby flowing water, and stagnant bodies of water. Conducting studies on geophysical, seismic, or environmental impacts would result in a higher score for the designed building for this GB parameter.

Another important GB assessment carried out during the design stage of the building is the sustainability of the construction materials used. The following GB parameters are normally taken into consideration during this process:

(a.) Materials: This assesses the sustainability of the materials used in the construction;

(b.) Sourcing of Materials: This assesses where the construction materials are sourced. Local sourcing of materials would score higher than sourcing from distant locations, and certified green construction materials would score more points than non-certified construction materials;

(c.) Indoor Environmental Quality: This assesses the quality of the built environment as it relates to comfort, health, and productivity of the occupants of the building;

(d.) Transportation: This assesses the environmental impact of transportation during the construction stage and occupants' access to public transportation during the operational stage of the building; and

(e.) Innovation: This assesses new energy efficient technologies used during the construction and the occupancy stages of the building.

The second step is the quantification of the impact of the construction process, including the transportation of construction materials to the construction site, transportation of construction waste from the site, and the on-site use of machinery. It also includes the use of energy and water at the construction site. Some of the universally accepted metrics for quantifying the sustainability of construction materials and construction processes are:

(a.) Global warming potential (GWP)
(b.) Ozone depletion potential (ODP)
(c.) Photochemical ozone creation potential (POCP)
(d.) Eutrophication potential
(e.) Acid potential

The third step considers the environmental impact and GHG emissions during the operational stage of the building. This process quantifies several GB parameters, such as innovation, and how efficiently the building uses energy and water.

Energy usage in the operational stage of the building is directly related to the GHG emissions associated with the building at its upper occupancy limit. In determining innovation, the assessment looks at the extent to which EE and RET solutions are implemented in the building and the resulting GHG emissions reduction. This methodology and the accompanying three steps are recommended for application in the proposed green buildings rating and certification scheme for Georgia.

1.5 Overview of Six Existing Green Buildings Rating and Certification Schemes

This section presents a review of six existing building rating and certification schemes (see Table 3). For a more comprehensive list of existing green building rating and certification schemes around the world, refer to Appendix 1.

	GB RATING TOOL	COUNTRY OF ORIGIN	LAUNCH DATE	NUMBER OF CERTIFIED PROJECTS (2011)
1.	BREEAM: Building Research Establishment Environmental Assessment Methodology	United Kingdom	1990	250,000
2.	LEED: Leadership in Energy and Environmental Design	United States	1998	116,000
3	Green Star	Australia	2002	19,000
4.	DGNB: Deutsches Gutesiegelnachhaltiges Bauen (German Certification for	Germany	2009	1,600

	Sustainable Construction)			
5.	CASBEE: Comprehensive Assessment System for Built Environment Efficiency	Japan	2002	500
6.	Building and Construction Authority (BCA) Green Mark	Singapore	2004	1,500

Table 3: Selected Green Building Rating and Certification Schemes

The basis for focusing on these six green building rating and certification schemes are:

(1) The large number of certified projects that have been assessed, rated, and certified by the schemes worldwide. Selecting schemes that are widely used and accepted will ensure that a Georgian green building rating and certification scheme modeled on these programs will also achieve international acceptability.

(2) The large geographical spread of the selected green building rating and certification schemes. This is important because Georgia covers several different climatic zones. The identification and utilization of environmental assessment parameters from existing green building rating and certification schemes that cover different climatic regions of the world will ensure that the different Georgian climatic factors are taken into consideration in formulating the environmental parameters for inclusion in a Georgian green buildings rating and certification scheme.

As shown in the table 4 below (which covers five of these six systems), the criteria considered under these schemes are similar in many cases.

Criterion	BREEAM	CASBEE	Green Star	LEED	DGNB Label
Management	+		+		+
Sustainable Sites				+	+
Indoor Environmental Quality		+	+	+	+
Quality of Service		+			+
Outdoor Environment		+			+
Energy	+	+	+	+*	+
Materials	+		+		+
Resources & Material		+		+	+
Off-Site Environment		+			(+)
Transport	+		+		+
Water	+		+	+**	+
Land Use & Ecology	+		+		+
Emissions/Pollution	+		+	+***	+
Innovation			+	+****	
Health & Well-Being	+				

* including Atmosphere ** Water Efficiency *** included in Energy
**** including Design

Table 4: Criteria considered in selected green building rating and certification schemes (Source: Dirlich, S., 2011)

The green building parameters selected for inclusion in any scheme depend on the climatic, geologic, geophysical, and environmental conditions of the region where the scheme is implemented. The criteria are measured using detailed methodologies that are specified by each rating and certification scheme.

The purpose of this analysis is to determine which existing green building rating and certification scheme(s) could be used in Georgia, or which green building rating and certification parameters could be selected and utilized in developing a unique Georgian green building rating and certification scheme. This would not be a new approach to developing a national green building rating and certification scheme; as pointed out in the *International Comparison of Sustainability Rating Tools* (Reed et al., 2009), many green building rating tools have been modified and adapted from earlier models that were originally developed in other countries.

The development of a green building rating and certification scheme will assist green buildings stakeholders in Georgia—including investors, developers, tenants, and government bodies—in making informed decisions about green buildings. Ultimately, the accepted green building rating and certification scheme for Georgia will need to be comparable with other existing schemes. As an example, a five-star building assessed by the Georgian scheme will need to be comparable with five-star ratings in other existing schemes (Reed et al., 2009).

1.5.1 Building Research Establishment Environmental Assessment Methodology (BREEAM)

BREEAM is a voluntary rating and certification scheme established by the Building Research Establishment in the United Kingdom (UK). BREEAM was the first buildings rating and certification system in the world and is now used in more than 50 countries. More than 300,000 buildings have received certified BREEAM assessment ratings since the program was launched in 1990 (Reed et al., 2010; BRE Group, 2014); the BREEAM rating has become one of the most comprehensive and widely recognized measures of a building's environmental performance.

The aims of BREEAM are to:

(a.) Mitigate the life cycle impacts of buildings on the environment;
(b.) Enable buildings to be recognized according to their environmental benefits;
(c.) Provide a credible, environmental label for buildings; and
(d.) Stimulate demand for sustainable buildings.

A Certificated BREEAM assessment is delivered by a licensed organization. In the UK, BRE-Global is an organization that uses assessors trained under the United Kingdom Accreditation Service (UKAS) at various stages in a building's life cycle. The BREEAM assessment provides clients, developers, designers, and others with:

(a.) Market recognition for low environmental impact buildings;
(b.) Confidence that tried and tested environmental practice is incorporated in the building;
(c.) Inspiration to find innovative solutions that minimize the environmental impact;
(d.) A benchmark that is higher than regulation;
(e.) A system to help reduce running costs, improve working and living environments; and

(f.) A standard that demonstrates progress towards corporate and organizational environmental objectives.

BREEAM assesses both new building developments and existing buildings and is used in a range of formats, from country specific schemes, adapted for local conditions, to international schemes intended for the certification of individual projects anywhere in the world. BREEAM mostly uses reference standards, but gives flexibility to apply national standards in each country.

Specific BREEAM versions allow any single type of building to be certified by applying tailor-made approaches. Corporate or industry-specific BREEAM schemes can also be developed by request -- e.g., BREEAM Toyota (specifically for Toyota facilities) or BREEAM Data Centres (BRE Group, 2014). BREEAM has expanded from its original focus on individual new buildings at the construction stage to encompass the whole life cycle of buildings from planning to in-use (operations) and refurbishment. Its regular revisions and updates are driven by the ongoing need to improve sustainability, respond to feedback from industry, and support the UK's sustainability strategies and commitments.

The following BREEAM versions are presently in operation:

- <u>BREEAM New Construction</u>: This BREEAM version is the standard against which the sustainability of new, non-residential buildings in the different countries and regions where the scheme is applied is assessed. Developers and their project teams use the scheme at key stages in the design and procurement process to measure, evaluate, improve, and reflect the performance of their buildings.

- <u>BREEAM International New Construction:</u> This is the BREEAM standard for assessing the sustainability of new residential and non-residential buildings in countries around the world, except for the UK and other countries with a national BREEAM scheme. This scheme makes use of assessment criteria that take into account the circumstances, priorities, codes, and standards of the country or region in which the development is located.

- <u>BREEAM In-Use:</u> This version of the scheme is applied to help building managers, investors, owners, and occupiers reduce the running costs and improve the environmental performance of existing buildings. It has three parts – Parts 1 (building asset) and 2 (building management) that are relevant for all non-domestic, commercial, industrial, retail, and institutional buildings. Part 3 (occupier management) is currently restricted to offices. BREEAM In-Use consists of a standard, user-friendly assessment methodology and an independent certification process that provides a map to improving sustainability credentials of existing buildings.

- <u>BREEAM Refurbishment:</u> This version provides a design and assessment method for sustainable housing refurbishment projects. [A scheme for non-housing refurbishment projects is being developed and is targeted for launch in 2014.]

- <u>BREEAM Communities:</u> This version focuses on the master-planning of whole communities.

<u>BREEAM National Scheme Operators:</u> Several countries in Europe have developed country-specific BREEAM schemes operated by National Scheme Operators (NSOs). There are currently BREEAM-affiliated NSOs in:

  - *United Kingdom* – BRE Global operates BREEAM in the UK
  - *The Netherlands* – the Dutch Green Building Council operates BREEAM NL
  - *Spain* – the Instituto Tecnológico de Galicia operates BREEAM ES

- *Norway* – the Norwegian Green Building Council operates BREEAM NOR
- *Sweden* – the Swedish Green Building Council operates BREEAM SE
- *Germany* – the German Institute for Sustainable Real Estate (DIFNI) is operating BREEAM DE
- *Austria* – DIFNI is operating BREEAM AT
- *Switzerland* – DIFNI is adapting BREEAM CH
- *Luxembourg* – DIFNI is adapting BREEAM LU

Schemes developed by NSOs can take any format as long as they comply with a set of overarching requirements laid down in the *Code for a Sustainable Built Environment*. They can be produced by adapting current BREEAM schemes to the local context, or by developing new local schemes. One option for developing a Georgian green building certification scheme would be to consider setting up a BREEAM NSO in Georgia, if consensus is reached to adopt BREEAM as the green building rating and certification scheme in the country.

Up to nine GB parameters are used in each BREEAM assessment scheme. The nine parameters (e.g., applied in BREEAM non-residential new construction) are:

- Energy
- Land use and ecology
- Water
- Health and well-being
- Pollution
- Transport
- Materials
- Waste
- Management

Through these different parameters, the whole impact of the building -- during the design, construction, and operational phases -- is assessed and scored under a credit (point)-based structure.

A BREEAM assessment uses recognized measures of performance, which are set against established benchmarks, to evaluate a building's specification, design, construction, and use. All BREEAM versions have the following three assessment stages:

- Pre-assessment: The first stage provides advice that allows for an early, informal review of the sustainability of a planned project, and provides advice on the elements that need to be incorporated into the detailed design and cost plan. An action list detailing the supporting evidence required from each member of the design team is issued to ensure all parties are aware of their obligations to achieve the desired BREEAM rating.

- Design Stage Assessment: During this interim BREEAM assessment, the building is assessed against the credit criteria given in the scheme manual, and credits are assigned based on compliance evidence supplied by the design team.

- Post Construction Stage Assessment: The final certified BREEAM assessment is carried out prior to handover and is based on evidence contained in the as-built drawings, calculations, and at least one site inspection by the BREEAM assessor. The post construction assessment is a confirmation that the commitments made at the design stage have been carried through during the construction phase.

For the purpose of demonstrating how a specific BREEAM version distributes the GB assessment points, the BREEAM multi-residential and eco-homes version is presented here. The BREEAM multi-residential and eco-homes system considers seven environmental assessment parameters, as shown below:

	Categories	Points
1.	Management	15
2.	Energy	25
3.	Health	15
4.	Water	5
5.	Materials	10
6.	Land Use	15
7.	Pollution	15
	TOTAL	**100**

Table 5: BREEAM multi-residential and eco-homes environmental assessment parameters

1.5.2 Leadership in Energy and Environmental Design (LEED)

Leadership in Energy and Environmental Design (LEED) is another prominent international green building rating and certification scheme, which has been adopted in more than 140 countries and territories. LEED is administered by the United States Green Building Council (USGBC). Since it was initiated in 1998, LEED has certified more than 300,000 projects worldwide (Reed et al., 2009); at the end of 2012, approximately 40% of the area pursuing LEED certification existed outside the U.S. LEED certification provides independent, third-party verification that a building, home, or community was designed and built using strategies aimed at achieving high performance in specified GB parameters such as: Sustainable Site Development, Water Savings, Energy Efficiency, Materials Selection, Health and Well-being, and Indoor Environmental Quality. LEED works throughout the building lifecycle – design and construction, operations and maintenance, tenant fit-out, and significant retrofit. Building projects satisfy prerequisites and earn points to achieve different levels of certification. Prerequisites and credits differ for each rating system, and teams choose the best fit for the project.

The Green Building Certification Institute (GBCI) is the third-party administrator of the LEED certification program. GBCI performs the technical reviews and verification of LEED-registered projects to determine if they have met the standards set forth by the LEED rating system. Dedicated technical experts -- LEED Accredited Professionals (APs) -- ensure building certification meets the highest levels of quality and integrity. The following LEED versions are currently in operation:

- LEED for New Construction & Major Renovations: This is a rating system that can be applied to commercial, institutional and residential buildings of four or more stories. The rating system has been applied to office buildings, manufacturing plants, hotels, laboratories and many other building types.

- LEED for Core & Shell: This version of LEED can be applied to speculative developments and core and shell buildings. Core and shell construction covers base building elements, such as the structure, envelope and building-level systems, like central heating and air conditioning.

- LEED for Schools: This program recognizes the unique nature of the design and construction of schools and, in addition to the environmental and health goals targeted by all LEED rating systems, LEED for Schools also addresses issues such as classroom acoustics, master planning, mold prevention and environmental site assessment. Launched in 2007.

- LEED for Retail: This version is designed to provide certification paths for ground-up retail construction and recognizes the unique nature of the new construction retail environment, addressing the different types of spaces that retailers need for their distinctive product lines.

- LEED for Healthcare: LEED for Healthcare addresses design and construction activities for both new buildings and major renovations of existing buildings.

- LEED for Commercial Interiors: This version addresses the specifics of tenant spaces, primarily in office and institutional buildings, and is designed for tenants who lease their space or do not occupy the entire building and wish to certify their space as a LEED green interior.

- LEED for Existing Buildings/Operations & Maintenance. This version identifies and rewards current best practices and provides an outline for buildings to use less energy, water and natural resources; improve the indoor environment; and uncover operating inefficiencies. The goal of the rating system is to institutionalize a process of reporting, inspection and review over the lifespan of a building.

- LEED for Homes: This is a green home certification system that provides guidance and verification that homes are designed and built to be energy- and resource-efficient and healthy for occupants. LEED can be applied to single and multifamily homes and is intended for both market-rate and affordable housing.

- LEED for Neighborhood Development: This rating system promotes smart location and design of neighborhoods that reduce vehicle miles traveled, and communities where jobs and services are accessible by foot or public transit. LEED for Neighborhood Development facilitates more-efficient energy and water use.

LEED also has tailored schemes for a limited number of regions/countries, e.g. LEED Italia, LEED Gulf (See Annex 1).

Updates to LEED: The hallmark of LEED and its ability to affect market transformation is due to its continuous improvement cycle that enables the rating system to increase in scope and stringency as market readiness increases and new technologies become widely available. _The pilot version, LEED New Construction (NC) v1.0, led to LEED NCv2.0, then LEED NCv2.2 in 2005. LEED was most recently updated in 2009, to LEEDv3. LEED v4, the next version of the rating system, will focus on increasing LEED's technical rigor, expanding the market sectors able to use LEED, and striving for simplicity in terms of usability. These updates are developed through an open, consensus-based process led by USGBC member-based volunteer committees, subcommittees, and working groups, in conjunction with USGBC staff. They are then subject to review and approval by the LEED Steering Committee and the USGBC Board of Directors prior to a vote by USGBC membership.

Prerequisites and Credits: Each category in a LEED rating system consists of prerequisites and credits. Prerequisites are required elements, or GB parameters that must be included in any LEED certified project. Credits are optional elements, or strategies that projects can elect to pursue to gain points toward LEED certification.

Points and Levels of Certification: LEED rating systems generally have 100 base points plus six Innovation in Design points and four Regional Priority points, for a total of 110 points. Each credit is allocated points based on the environmental impacts and human benefits of the building-related impacts that it addresses. Projects achieve certification if they earn points according to the following levels:

(a.) Certified: 40–49 points
(b.) Silver: 50–59 points
(c.) Gold: 60–79 points
(d.) Platinum: 80+ points

For the purpose of demonstrating how a specific LEED version distributes the GB assessment points, the LEED-Homes version is used here as an example. The LEED-Homes version has seven environmental assessment parameters, shown in Table 6. (Katz, 2012)

	Categories	Points
1.	Sustainable sites	26
2.	Energy and atmosphere	35
3.	Regional priorities	4
4.	Water efficiency	10
5.	Materials and resources	14
6.	Indoor environmental quality	15
7.	Innovation and design	6
	TOTAL	**110**

Table 6: LEED-Homes environmental assessment parameters

1.5.3. Deutsches Gutesiegelnachhaltiges Bauen (DGNB):

The DGNB was developed in Germany in 2009, and has become popular in several European countries and China. Like LEED and BREEAM, the DGNB assesses environmental performance of buildings. The distinctive feature of the system is that it also is focused on economic and social sustainability through certification of up to 50 sustainability criteria related to ecology, economy, socio-cultural aspects, technology, process work flows, and sites. The system is based on voluntarily outperforming the concepts that are common or usual today.

The DGNB presently has two versions for new developments – one for offices and administrative buildings and another for shopping malls. Quality is assessed comprehensively over the entire life cycle of the building.

DGNB introduced its residential green building rating in 2010. This rating has five environmental assessment parameters, as shown in Table 7:

S/N	Categories	Points
1.	Ecological quality	22.5
2.	Economical quality	22.5
3.	Social quality	22.5
4.	Technical quality	22.5
5.	Process quality	10.0
	TOTAL	**100**

Table 7: DGNB environmental assessment parameters

1.5.4 Green Star

Green Star is a comprehensive, voluntary environmental rating system that evaluates the environmental design and construction of buildings and communities. It was established in Australia in 2002 and has certified more than 19,000 projects – including apartment buildings, schools, university buildings, hospitals, offices, shopping centers and industrial facilities -- in Australia and New Zealand.

Green Star was developed for the property industry in order to:

(a.) Establish a common language;
(b.) Set a standard of measurement for built environment sustainability;
(c.) Promote integrated, holistic design;
(d.) Recognize environmental leadership;
(e.) Identify and improve life-cycle impacts; and
(f.) Raise awareness of the benefits of sustainable design, construction, and urban planning.

The currently available Green Star versions include:

(a.) Green Star - Education v1
(b.) Green Star - Healthcare v1
(c.) Green Star - Industrial v1
(d.) Green Star – Multi-Unit Residential v1
(e.) Green Star - Office v3
(f.) Green Star - Office Interiors v1.1
(g.) Green Star - Retail Centre v1
(h.) Green Star - Office Design v2
(i.) Green Star - Office As Built v2
(j.) Green Star - Public Building v1

For the purpose of demonstrating how a specific Green Star version distributes the GB assessment points, the Green Star multi-unit residential version is used here as an example. The Green Star multi-unit residential has nine environmental assessment parameters, as shown in Table 8.

S/N	Categories	Points
1.	Management	8
2.	Indoor Environmental Quality	12
3.	Energy	26
4.	Transportation	14
5.	Water	14
6.	Materials	12
7.	Land Use and Ecology	11
8.	Emissions	5
9.	Innovation	8
	TOTAL	**110**

Table 8: Green Star multi-unit residential environmental assessment parameters

1.5.5 Comprehensive Assessment System for Built Environment Efficiency (CASBEE)

Comprehensive Assessment System for Built Environment Efficiency (CASBEE) is the Japanese green buildings rating scheme. CASBEE is hosted by the Japan Green Building Council and was launched in 2002. CASBEE is one of the leading Asian green building certification schemes, with more than 500 buildings certified as of 2011.

CASBEE was developed with the following principles in mind:

- The systems should award high assessments to superior buildings, thereby enhancing incentives to designers and others.
- The assessment system should be as simple as possible.
- The system should be applicable to buildings in a wide range of building types.
- The system should take into consideration issues and problems peculiar to Japan and Asia.

The CASBEE rating system includes several components relevant to the green buildings rating system under discussion for Georgia. The existing CASBEE tools include:

- *CASBEE for Pre-design*: Assists owners, planners, and others involved at the planning (pre-design) stage of the project. It has two main roles:

  (a.) To assist in grasping issues such as the basic environmental impact of the project and selecting a suitable site; and
  (b.) To evaluate the environmental performance of the project at the pre-design stage.

- *CASBEE for New Construction*: A self-assessment system that allows architects and engineers to raise the built environment efficiency of the building under consideration during its design process. The system enables assessments based on a building's design specification and the anticipated performance. It can also serve as a labeling tool when the building is subjected to third-party assessment.

- *CASBEE for Existing Buildings*: An assessment tool targeting the existing building stock, based on operation records for at least one year after completion. It was developed to be applicable for asset assessment as well.

- *CASBEE for Renovation*: This tool can be used to generate proposals for building operation monitoring, commissioning, and upgrade design.

In addition, the CASBEE system also includes CASBEE for Home (detached house), CASBEE for Urban Development (for whole communities), CASBEE for Cities, CASBEE for Urban Area and Buildings (for a building site for multiple buildings), CASBEE for Property Appraisal, and CASBEE for Market Promotion.

For the purpose of demonstrating how a specific CASBEE version distributes the GB assessment points, the CASBEE new construction for homes version is used here as an example. The CASBEE new construction for homes has six environmental assessment parameters, as shown in Table 9 below:

S/N	Categories	Points
1.	Indoor Environmental Quality	20
2.	Quality of Service	14
3.	Outdoor Environment On-site	14

4.	Energy	26
5.	Resources and Materials	22
6.	Offsite Environment	14
	TOTAL	**110**

Table 9: CASBEE-Homes environmental assessment parameters

1.5.6 Building and Construction Authority (BCA) Green Mark

Green Mark is the green building rating scheme established by Singapore's Building and Construction Authority (BCA) in 2004. The BCA Green Mark system for residential buildings and landed houses (low rise residential buildings) has five environmental assessment parameters, as shown in Table 10:

S/N	Categories	Points
1.	Indoor environmental quality	10
2.	Environmental protection	20
3.	Energy efficiency	74
4.	Water	8
5.	Other green features	8
	TOTAL	**110**

Table 10: BCA Green Mark residential and landed houses environmental assessment parameters

1.6 Comparison of Some Green Building Environmental Parameters

In order to help guide the development of a Georgian green building rating and certification scheme, this report examines the different GB parameters and how they are addressed in the six selected GB rating and certification schemes. Understanding how these parameters are selected and weighted in the various existing GB rating and certification schemes will be important for selecting and weighting suitable parameters for the Georgian Green Buildings Rating & Certification Scheme.

To simplify the discussion, the sections below refer only to residential green buildings. The identification and weighting of GB parameters for other versions of the Georgian green buildings rating and certification scheme (non-residential and public buildings) can be designed based on an understanding of how GB parameters are selected and weighted for residential schemes.
The main reference for this subsection (including all of the figures below) is Gang Liu et al.'s *Long-life Comparison of Worldwide Certification Systems for Sustainable Buildings* (2010).

1.6.1 Energy Parameter

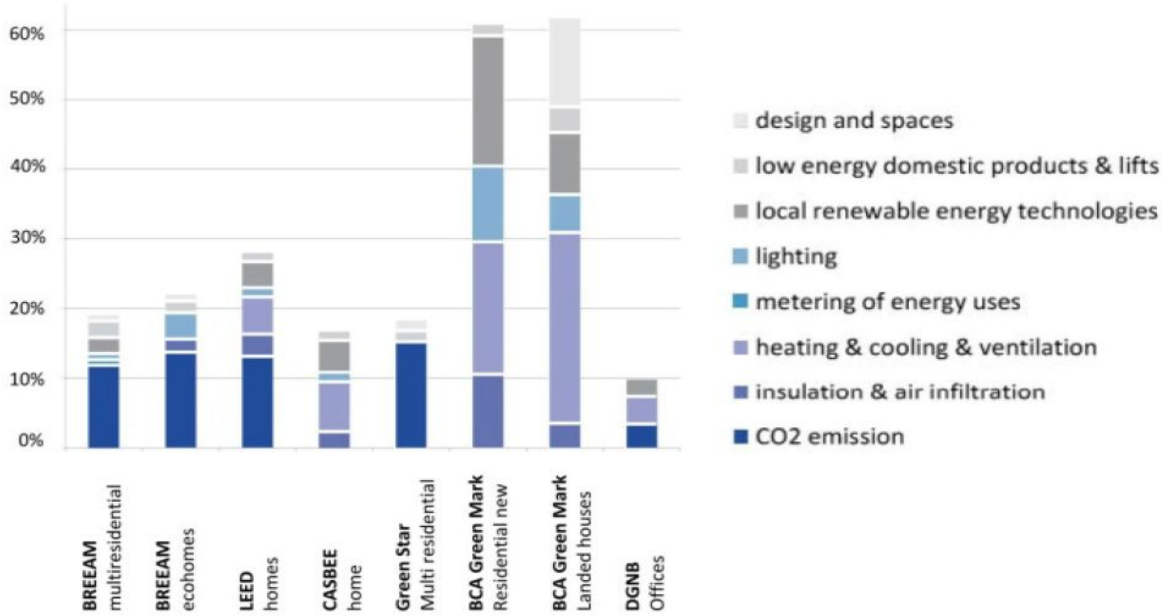

Figure 1: Energy as an environmental assessment parameter

From the standpoint of the EC-LEDS Clean Energy Program, energy as a GB parameter is very important for Georgia. This is because of the direct relationship between energy consumption and GHG emissions (for the building subsector) in the Georgian economy. The associated GHG emissions for buildings could be compared with GHG emissions for other subsectors of the Georgian economy, and the magnitude of the GHG emissions attributed to buildings could provide impetus for the government of Georgia to implement mandatory EE, RET, and GB components for buildings.

The overall weight for energy as a green buildings parameter (Figure 1) for residential green buildings ranges from 10% (for the DGNB rating scheme) to 62% (for BCA Green Mark). The average value is 30%. Energy as a green building parameter is divided into the following sub parameters (Gang Liu et al., 2010):

(a.) Carbon emissions
(b.) Building permittivity – air infiltration
(c.) HVAC
(d.) Metering of energy uses – measuring, monitoring and targeting installations
(e.) Lighting
(f.) Local renewable energy technologies
(g.) Low energy domestic products and lifts
(h.) Design and spaces

1.6.2 Site and Transportation Parameter

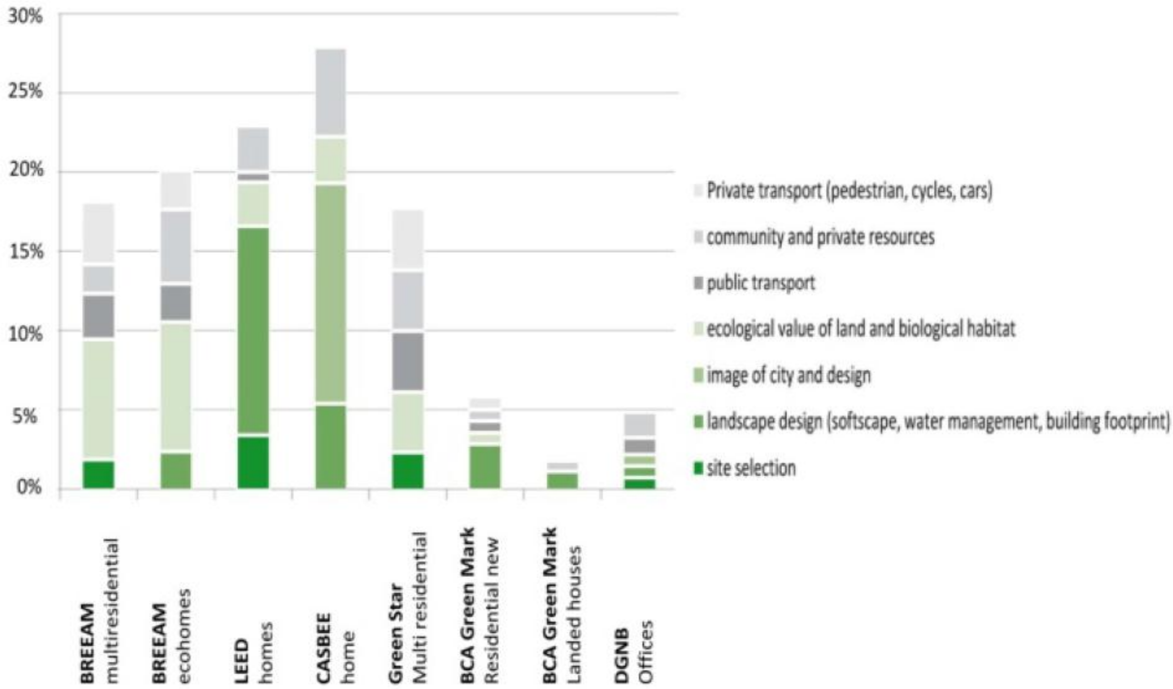

Figure 2: Site and transportation as environmental assessment parameters

The weight for the site and transportation green buildings parameter for residential green buildings ranges from 2% (for the BCA Green Mark rating scheme) to 27.5% (for CASBEE). The average value is 12.5%. This parameter is divided into the following sub-parameters:

(a.) Private transportation (e.g., pedestrian, cycles, cars);
(b.) Community and private utility resources;
(c.) Public transportation;
(d.) Landscape design;
(e.) Image of city and design;
(f.) Ecological value of land and biological habitat; and
(g.) Site selection.

1.6.3. Indoor Environmental Quality Parameter

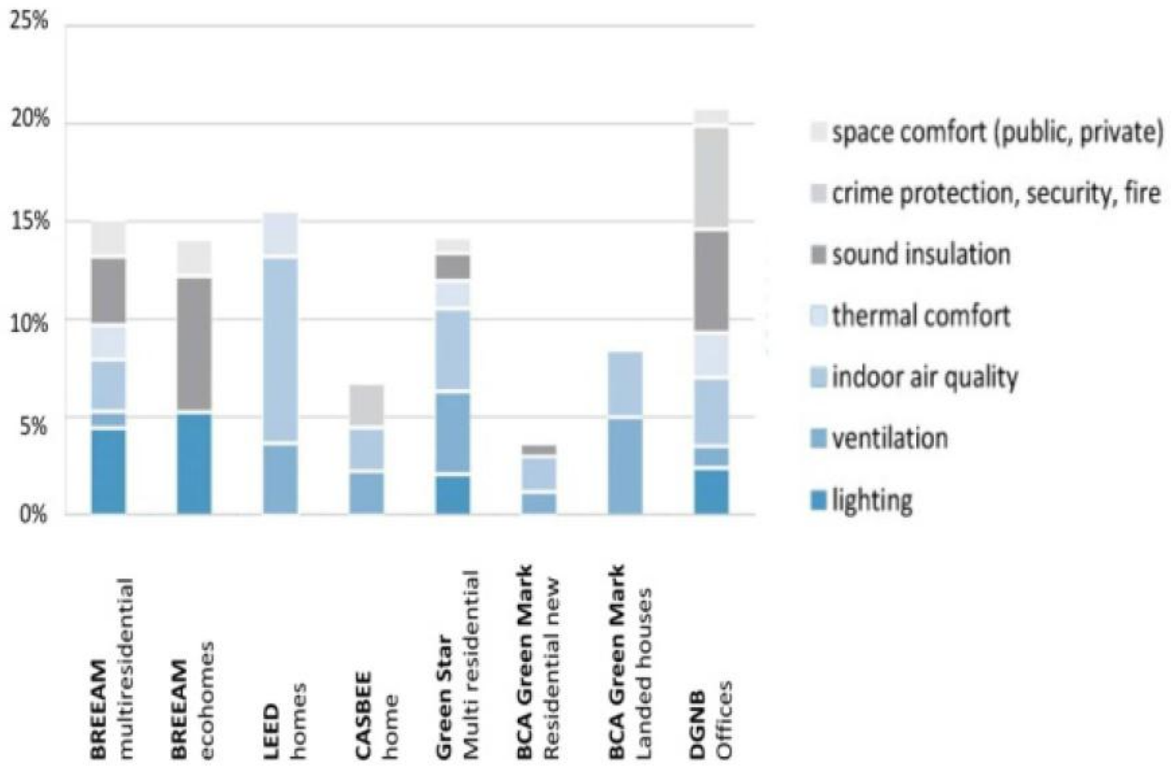

Figure 3: Indoor environmental quality as an environmental assessment parameter

This is another GB parameter which is important for Georgia. Since the Soviet Era, indoor environmental quality has always been considered in designing and constructing buildings in Georgia. This is therefore one GB parameter recommended to be included in all versions of the Georgian green buildings rating and certification scheme.

The weight of indoor environmental quality as a parameter for residential green buildings ranges from 3% (BCA Green Mark) up to 22% (DGNB). The average value is 12%. This parameter is divided into the following sub-parameters:

(a.) Lighting;
(b.) Ventilation;
(c.) Indoor air quality;
(d.) Thermal comfort;
(e.) Sound insulation;
(f.) Crime, security, and fire protection; and
(g.) Space comfort, public and private.

1.6.4 Materials and Waste Parameter

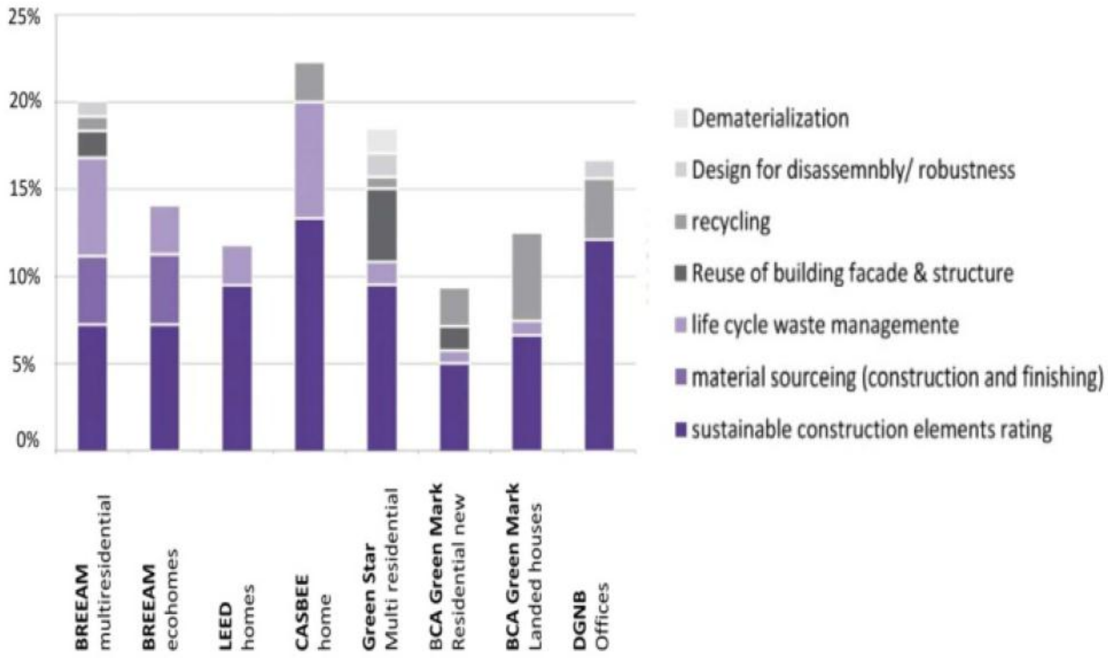

Figure 4: Materials and waste as environmental assessment parameters

Materials and waste as a parameter for residential green buildings is weighted from 9% to 22% by the various green building rating systems. The average value is 14%. This parameter is divided into the following sub-parameters:

(a.) Sustainable construction elements ratings;
(b.) Material sourcing (construction and finishing);
(c.) Life-cycle waste management;
(d.) Reuse of building façade and structure;
(e.) Recycling;
(f.) Design for disassembly/robustness; and
(g.) Dematerialization.

1.6.5. Water Parameter

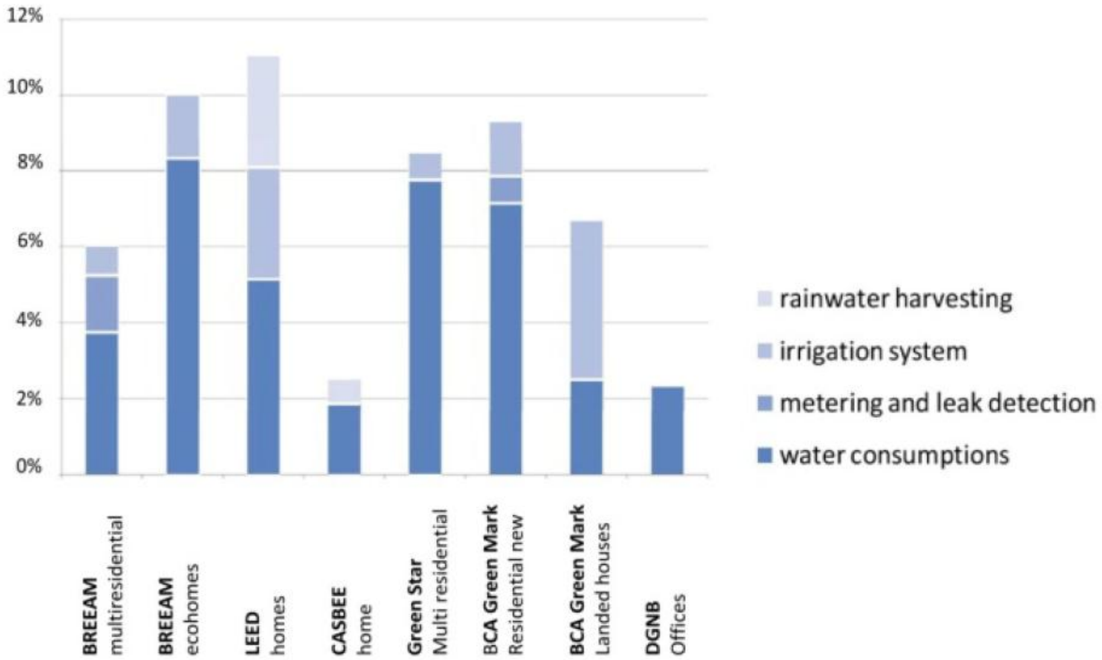

Figure 5: Water as an environmental assessment parameter

Water as a GB parameter is very important for Georgia. This is because of the increasing water demand in Georgia's cities and the potential of water shortages to generate internal or even regional conflict. Therefore, opportunities for water conservation in the building subsector should be given priority. A common benchmark for water use as a GB construction parameter is 32m^3 per bed-space per year.

In the six green building rating systems, the weight of water-related factors as a parameter for residential green buildings ranges from 2.5% up to 11%. The average value is 7%. Water use in building construction is climate dependent. In climates/regions where natural water (rivers, springs, or underground aquifers) abounds, the value of water as a green building parameter is relatively low, while in arid regions, the importance of water as a green building parameter increases.
This parameter is divided into the following sub-parameters:

(a.) Water consumption;
(b.) Metering and leakage detection;
(c.) Irrigation system; and
(d.) Rainwater harvesting.

1.6.6. Construction Management Parameter

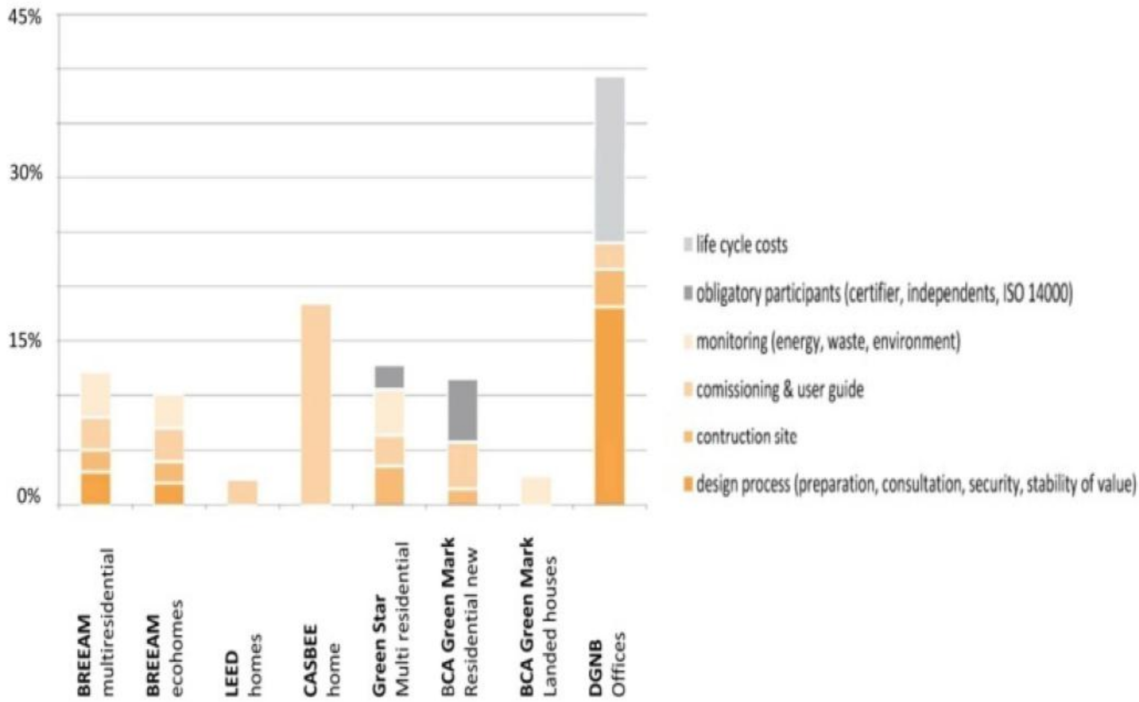

Figure 6: Construction management as an environmental assessment parameter (Source: Gang Liu et al., 2010)

The weighting of Construction Management as a parameter for residential green buildings ranges from 2% (LEED) to 38% (DGNB). The average value is 13%. Construction Management as a green building parameter is divided into the following sub-parameters:

(a.) Design process (preparation, consultation, security, stability of value);
(b.) Construction site;
(c.) Commissioning and user guide;
(d.) Monitoring (energy, waste, environment);
(e.) Obligatory participants (certifiers, independents); and
(f.) Life-cycle costs.

The degree of importance of construction management in residential building construction is dependent on the complexity of the development. In countries where mixed-use high-rise residential construction is very common, the construction management parameter is generally given a higher rating value. In countries where less complex structures (e.g., bungalows) account for the majority of residential construction, construction management as a residential green building parameter is typically given a lower value.

There is not enough information to judge how operation and maintenance is currently applied as a parameter for conventional residential buildings in Georgia, nor how it can be implemented as a GB parameter for residential buildings in Georgia.

The buildings that were visited during two site visits in Georgia were high-rise residential buildings. In these buildings, each apartment was owned privately by an individual family. Information was not obtained on how these multi-floor (individually owned) high-rise residential apartments are maintained.

Furthermore, there are many single or double floor family-owned existing residential buildings in Georgia. Construction of these buildings was managed by the owners, who are not professional construction managers. Therefore it is recommended that studies be commissioned by the Georgian Green Buildings Rating and Certification Board (GGBRCB) to understand how construction management as a GB parameter could be integrated into the residential buildings version of the Georgian GB rating and certification scheme, if construction management is included as a GB parameter for residential buildings.

1.7 The Process of Assessing Buildings

All certification systems rank buildings against a maximum number of points (e.g., 100 points) that a building can score. The main GB parameters have been presented in Table 4 in Section 1.5. Each GB parameter consists of numerous sub-parameters and indicators. The sum of the scores of all sub-parameters provides the score for that specific GB parameter. Some ranking systems also award points (e.g., 10 points) for innovation.

The building is then awarded a certification grade which is directly related to the total number of points scored. Certification grades range from "passing" to "outstanding," and typically include: certified, good or silver, very good or gold, excellent or platinum. The specific certification grades for the six selected certification systems are shown in Figure 7.

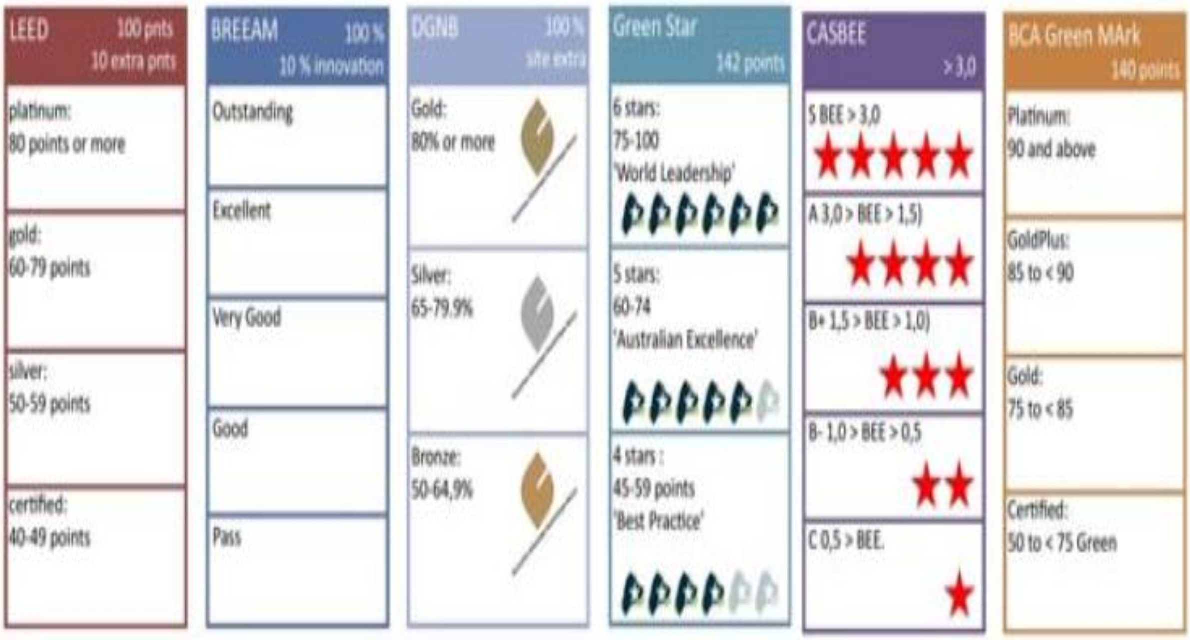

Figure 7: Scoring parameters for different green buildings rating and certification schemes *(Adapted from Gang Liu et al., 2010).*

From a technical analysis point of view, the German DGNB scheme could be viewed as the GB rating and certification system with the most comprehensive approach. It not only takes into consideration ecological factors, but it also takes account of economic, socio-cultural, functional, technical, and procedural qualities of the building. However the German DGNB scheme puts low emphasis on the importance of energy use as a GB parameter for the different stages of design, construction, and operation of buildings.

1.8 Versions of Green Building Rating and Certification Schemes

All of the identified green buildings rating and certification schemes (Annex 1) have developed processes that allow for the evolution of new sets of modalities, parameters, and methodologies for assessing, rating, and certifying particular types of buildings. The modalities refer to the steps to be followed in carrying out the assessment, rating, and certification process. The parameters refer to the specific sustainability measures and targets applied to the construction materials, construction processes, and building performance. The methodology is the evaluation route for quantifying the modalities and parameters.

When they were initiated, each green building rating and certification scheme put in place the modalities, parameters and methodologies for rating and certifying a limited set of building types, beginning with existing buildings. Subsequent versions of the schemes included an expanded range of building types; for example, BREEAM's rating and certification system focused first on existing residential and commercial buildings, and new-build eco-homes and other categories were added to the scheme later.

Presently, BREEAM assesses almost 20 different types of buildings, including homes and office, retail, and commercial buildings. The advantage of the existence of several versions within a specific buildings rating and certification scheme is that it allows detailed and specific assessments. However, multiple versions of each scheme can have the disadvantage of reducing the transparency and comparability of the assessment and certification process.

SECTION TWO: REVIEW OF CURRENT CONSTRUCTION PRACTICES AND AVAILABLE GREEN BUILDINGS CONSTRUCTION MATERIALS IN GEORGIA

Georgia has been a state for over 3,500 years and has a strong record of traditional construction methodologies for buildings, dating back to the medieval period. This section of the report reviews the construction practices in Georgia during three different historical periods:

1. Pre-Soviet (before 1921) construction era
2. Soviet (1921-1990) construction era
3. Post-Soviet (1991-Present) construction era

Some aspects of the sustainable construction (green buildings) concept were practiced during the Pre-Soviet Era in Georgia. Examples of GB parameters that were implemented in buildings included:

(a.) Site sustainability: construction sites were selected based on the type of building to be constructed. For example, residential buildings were constructed on and dug into mountain slopes in order to benefit from the thermal masses provided by the mountain sides.

(b.) Materials: available stones were used in building construction. Earth was used as mortar to hold the stones together.

(c.) Sourcing of construction materials: construction materials were sourced locally, to avoid the need to move them over long distances.

EE, RET and GB parameters were not taken into consideration in construction of residential buildings during the Soviet Era. However, during this period, indoor environmental quality was an important factor considered when designing air flow in and out of buildings. In post-Soviet Georgia (1990-Present), EE and RET concepts have not been implemented in buildings as a rule. GB concepts are also not in the mainstream of building designs.

2.1 Pre-Soviet Construction Era in Georgia

According to Levan Natadze, Director of the Green Building Council of Georgia (GBC-G), the oldest record of Georgian homogenous structures shows residential and public structures constructed during the 2^{nd} and 3^{rd} millennia BC. These structures are not well-preserved, but Georgian building scientists have carried out methodical studies on these structures following their excavation. The studies have provided valuable knowledge about the original thermal properties as well as thermal performance of early Georgian buildings.

Figure 8: Ancient buildings in Georgia displaying traditional (green buildings) construction materials

The main parameters considered in designing and building these structures were sustainability and strategic (defense and security) considerations. This is particularly evident in the analysis of ancient residential buildings. Aleksandre (Sandro) Ramishvili is a practicing architect and faculty member of Illia University in Tbilisi. He has designed and supervised the construction of several buildings which incorporate green building parameters. Ramishvili explained, during one consultation, that some sustainability concepts were considered and applied in the design and construction of pre-Soviet dwellings in Georgia, including:

1. Substantial thermal mass of both loadbearing and non-loadbearing structures

Thick external walls were built of stones and earth or earthen bricks. The thick walls accumulated heating and cooling effects during daily thermal peaks and troughs. These provided appropriate thermal buffers, delivering space heating during cool periods and space cooling during warm periods.

Mr. Ramishvili suggested that for the proposed Georgian green buildings rating and certification scheme, serious consideration should be given to the concept of constructing buildings with adequate thermal mass for external walls (and even internal walls), a concept which was practiced during pre-Soviet times in Georgia.

The prominence of building thermal mass in the proposed Georgian GB rating and certification scheme would impact modern green building concepts, as shown in Table 11:

	GREEN BUILDING PARAMETER	**IMPACT ON BUILDINGS RATED WITH THE PROPOSED GEORGIAN GB RATING AND CERTIFICATION SCHEME**
1.	Indoor air quality	Thick external walls would provide adequate thermal buffer between indoor and outdoor temperature. This would assist in preventing condensation in the interior walls of buildings. The absence of condensation would reduce humidity levels in the indoor environment, which would mitigate the possibility of microbial growth in the indoor environment. These cumulative effects would

		improve the indoor air quality of the built environment.
2.	Health & well-being	The improved indoor air quality resulting from thick external walls would have a direct benefit for the health and well-being of the building's occupants.
3.	Energy	Thick external walls also would provide a thermal buffer between indoor and outdoor climate. This would result in reduced heat-loss from the building to the external environment. Therefore, during the operational stage of the building, less energy would be needed to maintain suitable indoor temperatures during winter seasons.
4.	Materials	The use of locally available stone aggregates in constructing thick external (as well as internal) walls of buildings would improve the score of the building for this parameter in the GB rating and certification scheme, if Materials as a GB parameter is applied in the Georgian scheme.
5.	Sourcing of materials	Igneous rocks abound in Georgia and rock aggregates can be obtained from this abundant source. Buildings constructed with locally available rock aggregates would score highly for this parameter in the GB rating and certification scheme, if Sourcing of Materials as a GB parameter is applied in the Georgian scheme.
6.	Transportation	There is an abundant supply of igneous rocks in Georgia, from which rock aggregates can be obtained. The use of such locally available materials would reduce long-distance transportation needs and earn a high score for this parameter in the GB rating and certification scheme, if Transportation as a GB parameter is applied in the Georgian scheme.

Table 11: Effect of adopting the pre-Soviet practice of constructing thick walls on a Georgian rating and certification scheme.

2. Half-cave space concepts

For strategic (defense and security) reasons, most early pre-Soviet Georgian settlements were located on mountains and hillsides. The settlements were developed in a compact manner. Houses were built on south-facing slopes. Houses shared walls with each other so as to minimize heat loss. Houses were built in levels (floors) – parts of the floor and balcony of one house formed the ceiling for the house located at the lower level. Another approach was to construct dwellings in specially selected coves (semi cave-like structures). Soil and vegetation was used to construct the roof while all sides of the dwelling were carved out of the mountains or hillsides. Thus, three walls of the building had extremely good thermal mass while the building's fourth (front) side was used for access and daylight.

The implementation of passive design concepts (including building orientation and constructing buildings in modular units) as was implemented during early pre-Soviet times in Georgia could help buildings earn higher scores in the proposed Georgian GB rating and certification scheme if innovation is included as a parameter in the Georgian scheme.

The inclusion of basements in the construction of modern buildings (replacing caves) as obtained during pre-Soviet times could replicate the security concept which coves provided. For the construction of modern buildings in Georgia, the inclusion of basements would provide additional envelopes which could serve as parking garages. This would help to improve the score for transportation (for the operational stage) of the building in the proposed Georgian GB rating and certification scheme, if Transportation as a GB parameter is applied in the Georgian scheme.

Figure 9: Homes built along mountainsides

The photos above show recent excavations of ancient buildings built into mountainsides (left) and unexcavated ruins (right). These show the utilization of locally available construction materials. Following these principles would improve the score of such buildings under the proposed Georgian GB rating scheme if Transportation, Materials, and Sourcing of Materials are considered parameters in the Georgian buildings rating and certification scheme.

2.2 Soviet Era (1921-1990) Construction in Georgia

According to Levan Natadze, Director of the Green Building Council of Georgia (GBC-G), conservative estimates indicate that over 75% of the existing Georgian building stock was constructed during the Soviet Era. Buildings constructed during this era therefore represent the potential for the most significant reductions in energy use and GHG emissions. It thus makes sense to pay special attention to the possibility of converting this building stock into low-energy and energy efficient buildings.

It would be extremely difficult to convert these buildings into green buildings, since most green building parameters—energy, water, materials, sourcing of materials, transportation—would be nearly impossible to assess due to the unavailability of historic documents and relevant information relating to the design and construction stages of the Soviet Era buildings.

A more realistic goal would be to convert this building stock into low-energy and energy-efficient buildings by carrying out the following steps:

(a.) Conduct Level Two energy audits for existing Soviet Era building stock;
(b.) Determine baseline utility (energy and water) consumption and baseline GHG emissions;
(c.) Determine and execute upgrades to areas of energy inefficiencies in these buildings, including building-envelope construction matrices (walls, roofs, ceilings and floors);
(d.) Determine and execute upgrades on areas of energy inefficiencies associated with building services, including:
  - lighting;
  - heating;
  - ventilation and air conditioning systems; and
  - domestic hot water systems;

(e.) Determine EE measures to be implemented to improve the building's utility (energy and water) performance;
(f.) Determine RET measures to be implemented to improve the building's energy performance;
(g.) Determine innovative engineering solutions which could be implemented to improve the building's utility (energy and water) performance;
(h.) Conduct level Two energy audits, to determine the impact of the EE and RET solutions implemented and to determine GHG emissions after implementation of EE and RET measures; and
(i.) Quantify GHG emission reductions after implementing EE and RET measures.

The range of EE, RET and innovative engineering solutions that can be implemented for the existing stock of buildings in Georgia is presented in subsection 3.2.5. Upon completion of the steps listed above, the existing stock of Soviet Era buildings in Georgia would achieve the highest possible rating for existing buildings, whether rated by the proposed Georgian GB rating and certification scheme or another chosen GB rating scheme. According to

Natadze, the Soviet construction period can be divided into several sub-periods, as described below.

Figure 10: Stock of Soviet Era construction of high-rise residential apartments

2.2.1 Early Soviet Era (1921-1937) Construction in Georgia

During this period, no unified building construction codes or laws existed; buildings were designed individually. Buildings of this era were mainly low-rise structures and were built mainly to provide the basic requirement of shelter. These buildings always had basements to serve strategic (safety and security) purposes, serving as shelters during military attacks. Important building parameters that were considered in the construction of buildings during this era included thermal mass and indoor environmental comfort, taking into consideration the effects of harsh winters in certain regions of the Soviet Union.

The building characteristics were as follows:

(i.) Bricks (45cm thick) were used for loadbearing and external walls;
(ii.) Timber beams were used for doors and windows;
(iii.) Timber panes were used to construct floors and staircases;
(iv.) Window and door frames were constructed of timber; and
(v.) Metal or slate sheets were used to construct sloped roofs.

Wood and coal was used in the heating of envelope spaces in these buildings during winter months.

Adopting some of the techniques for constructing buildings implemented during the Early Soviet Era (1921-1937) may help achieve high scores for new constructions in the proposed Georgian green building rating and certification scheme. The use of bricks would ensure that new constructions score highly for Materials, Sourcing of Materials and Transportation if these parameters are included in the Georgian GB rating and certification scheme.
The use of timber would ensure that new constructions score highly in the Materials and Sourcing of Materials GB parameters if these parameters are included in the proposed

Georgian GB rating and certification scheme. If the timber is sourced from certified forests, it would result in an even higher score.

2.2.2 Stalin Era (1937-1956) Construction in Georgia

According to Natadze, during this era a unified building construction code was in operation. Many buildings of this era thus had similar appearances, underlining the control of the Soviet Union. The buildings were mainly constructed for working class families and comprised one or two bedroom apartments in blocks of 5-9 floors. The main environmental features taken into consideration in designing and constructing buildings during the Stalin Era were thermal properties of the buildings, indoor air quality, and use of locally available construction materials.

Characteristics of buildings constructed in this era include:

- (i.) These buildings were designed and constructed according to the building regulations in force at the time;
- (ii.) Buildings included a basement for strategic (defense and security) reasons;
- (iii.) Bricks with a thickness of 50cm were used in the construction of loadbearing and external walls;
- (iv.) Internal walls were constructed with bricks with a thickness of 38cm;
- (v.) Reinforced concrete was used in the construction of floors and ceiling slabs;
- (vi.) The multi-story buildings of the time contained enclosed staircases which were constructed with reinforced concrete;
- (vii.) Single timber panes (2-3cm thick) were used to construct doors. In areas of the Soviet Union where very harsh winters occurred, timber constructed window panes with a thickness of 4-5cm were common; and
- (viii.) These buildings were characterized by the presence of attics and sloped metal roofs.

In the early years of this era, coal was used in the heating of envelope spaces in these buildings during winter months. During the 1960s and 1970s, some redesigning of internal buildings services was carried out.

Gas and electricity were introduced to provide space heating during this era. Overall, these buildings also had very good thermal performance as a result of the very thick external walls. Air flow into and within each apartment was carefully planned, resulting in very good indoor air quality. These buildings were also characterized by the absence of dry rot, damp internal walls, and condensation.

Adopting some of the techniques for constructing buildings implemented during the Stalin Era (1937-1956) may help achieve high scores for new construction in the proposed Georgian green building rating and certification scheme. The use of bricks with a thickness of 50cm for the construction of loadbearing external walls and 38cm for internal walls would ensure that newly constructed buildings score highly for GB parameters including Energy, Materials, Sourcing of Materials, Transportation, and Indoor Environmental Quality if these parameters are included in the Georgian GB rating and certification scheme.

The use of timber would ensure that new constructions score highly for Transportation, Materials and Sourcing of Materials as GB parameters if these parameters are included in the proposed Georgian GB rating and certification scheme. If the timber is sourced from certified forests, the building would receive an even higher score.

2.2.3 Post-Stalin Era (1956-1990) Construction in Georgia

According to Natadze, buildings constructed during this era were low-cost and minimalistic, as a result of the industrialization of the country and demand for a greater number of inexpensive buildings. Also, a standard design and prefabricated building envelopes were used for thousands of houses.

Figure 11: Typical structure of post-Stalin era multi-floor residential blocks

The main environmental features taken into consideration in designing and constructing buildings during the post-Stalin era were thermal properties of the buildings, indoor quality, and use of locally available construction materials. Some characteristics of buildings constructed in this era are as follows:

(i.) Buildings of this era were designed and constructed according to the existing building regulations, adhering to design parameters for walls, floors, and ceiling thicknesses;

(ii.) The buildings constructed during this era normally contain basement features. There are no heating features in the basements. However, the main building operational services, including water supply and sewerage, are laid in the basements. The heat transmission coefficient of the ground floors in multi-floor buildings constructed during this era ranged between U=2.19 W/m^2 ^{O}C and U=2.07 W/m^2 ^{O}C;

(iii.) Diversification of building envelopes and loadbearing structures: Reinforced concrete beams were used for loadbearing in these buildings. External walls of the building were 40cm thick and made of scoria concrete panels. The external walls did not have wall cavity insulation but the thickness of the external walls compensated for the absence of external wall insulation. Repairs are normally carried out at intervals, though many of the multi-floor apartments constructed during earlier construction eras have suffered neglect and are in dire need of maintenance. The heat transmission coefficient of the external walls of upper floors of these buildings ranges between U=1.20 W/m^2 ^{O}C and U=1.29 W/m^2 ^{O}C;

Figure 12: Characteristic flat roof surface of post-Stalin era multi-floor residential blocks

(iv.) Reinforced concrete framed or light concrete blocks conservatories were used;

(v.) Single glazed windows (U=5.52 W/m^2 ^{O}C) with timber frames were used in the Tbilisi Region. In regions where the winter was very harsh, double glazed timber framed windows were used;

(vi.) Mainly open staircases were used. Only in harsh winter zones were enclosed staircases constructed;

(vii.) Many of the buildings constructed during this era consisted of high-rise concepts;

(viii.) The buildings also had attics but were characterized by flat roofs. The roofs consisted of 2 layers of roof felt (each 0.003M thick), one layer of fiberglass (0.002M), expanded clay filling (0.15M), reinforced concrete panel (0.2M), an air space (1.5M) communicating with the outside air, and the floor of the attic, a reinforced concrete panel (0.2M).

The heat transmission coefficient of roofs for buildings constructed during this era was calculated to be in the range of U=1.45 W/m^2 ^{O}C and U=1.57 W/m^2 ^{O}C.

During this era, elevators were introduced as building services in the construction of multi-floor buildings. Elevators were constructed as part of the general building circulation areas and were enclosed while staircases were exposed. The thermal performances of buildings in this era were similar to those in earlier Soviet Eras, primarily due to the similar thickness in the external walls. The indoor air quality was also very good because conscious efforts were made to design individual apartments to ensure that, even in winter, air intake and air circulation within each apartment envelopes was good.

The technical performance of buildings constructed during the post-Stalin Era (1956-1990) was lower than the two previous eras. The most glaring change in building components was the thermal performance of external walls. The thickness of external walls reduced from 50cm to 40cm. This reduction in dimension meant a drop in thermal performance of about of about 12%. It would not be advantageous to adopt this building standard for new constructions in Georgia. Adopting this standard would not enable a new construction to score highly in the proposed Georgian green building rating and certification scheme.

Another building component which would not improve the thermal performance of buildings is the open staircases for post-Stalin Era (1956-1990) construction. Exposed staircases would result in increased exposed areas of the external walls. Adopting this standard would not enable a new construction to score highly in the proposed Georgian green building rating and certification scheme.

Adopting particular techniques for constructing buildings implemented during the post-Stalin Era may help achieve high scores for new construction in the proposed Georgian green building rating and certification scheme. One such technique is the use of double glazed windows with timber frames. The use of double glazing would ensure that new construction scored highly for Materials as a GB parameter, if this parameter is included in the proposed Georgian GB rating and certification scheme.

If double glazed windows with timber frames obtained GB construction Material certification, the buildings in which such double glazed windows were installed would score even higher for the parameter, if Materials is included as a GB parameter in the proposed Georgian GB rating and certification scheme.

The use of timber in window, door, or other glazed frames would result in a higher score for Materials as a GB parameter; and if the timber is sourced from certified forests, the new buildings would score even higher, if Materials is included in the proposed Georgian GB rating and certification scheme.

2.2.4 Building services installations in Soviet Era Buildings in Georgia

High-rise apartment blocks constructed during the post-Stalin era were supplied with district heating and hot water. Since the collapse of the Soviet Union, there is no functional district heating system operating in Georgia. The pipelines that supplied gas and hot water to buildings constructed during this era have been vandalized and disconnected by inhabitants because of the absence of district heating.

In the company of Levan Natadze, Director of the Green Building Council of Georgia (GBC-G), and Nino Lazashvili of Winrock Georgia, multiple site visits were conducted. In Tbilisi, two apartment blocks were visited, from two different sub-administrative districts. Both were constructed during this era. Rustavi and Gori, two independent self-governing cities not far from Tbilisi, were also visited.

Each apartment owner presently installs modular hot water and space heating systems. During site visits, the operational efficiencies of the equipment were observed to be very low. Majority of the installed components was over 15 years old. . In most apartments, KARMA or Ariston modular gas heaters or electric oil heaters are used for space heating.

Figure 13: Individual gas-fired water heaters - KARMA model (left) and ARISTON model (right)

There is no centralized domestic hot water system in Georgia. Domestic hot water supply for each apartment is individualized. The volume of hot water supply depends on individual apartment capacities and domestic hot water is mainly provided with the help of modular units. Either instantaneous gas water heaters or electric powered accumulative heaters are used, with ARISTON and THERMEX being among the most popular models.

Figure 14: Individual gas fired water heaters ARISTON (left) and electric powered accumulative water heater THERMEX (right)

2.2.5 Implementation of EE and RET solutions for existing Soviet Era Building Stock

As noted above, it will not be possible to implement classical green buildings concepts for the stock of Soviet Era constructed buildings in Georgia. It will, however, be possible to implement some EE and RET solutions for these buildings and thus achieve substantial energy savings. For the purpose of the EC-LEDS Clean Energy Program, the achieved energy savings also can easily be translated into quantifiable GHG emissions reductions.

Examples of EE & RET which could be implemented in Soviet Era buildings include:

(i.) Thermal modernization and façade insulation for all residential and commercial buildings constructed during the Soviet Era. This can be done through thermal insulation of the external walls (and façades where applicable) for existing buildings. Such actions could potentially contribute about a 20–25% reduction in energy consumption. This has the potential of contributing about 15–22% in GHG emissions reductions attributed to existing buildings in Georgia.

(ii.) Converting to energy efficient lighting in all residential, commercial, and public buildings constructed during the Soviet Era. Implementation of lighting conversions in existing buildings has demonstrated that such schemes have the potential to contribute reductions of about 13–16% in existing energy consumption -- which can reduce GHG emissions attributed to existing buildings in Georgia by about 7–11%.

(iii.) Reintroducing modular centralized heating and domestic hot water systems for communities of high-rise buildings. After the collapse of the Soviet Union, municipal or district heating for existing buildings also collapsed. Each apartment owner introduced individual apartment heating and domestic hot water systems. For communities of modular existing high-rise buildings, the reintroduction of communal heating powered by energy efficient and RET solutions has the potential to reduce existing energy consumption by 15-19% and GHG emissions by 9-13%.

(iv.) Installing solar thermal and solar photovoltaic (SPV) units on appropriately sloped and suitably oriented rooftops in existing high-rise residential, commercial, and public buildings constructed during the Soviet Era. The installed SPV units could power lighting while the solar thermal units could provide hot water. For existing buildings in Georgia, installing SPV and solar thermal units on the roofs of existing high-rise residential and commercial buildings in Georgia could reduce both energy consumption and GHG emissions by 7-11%.

(v.) Replacing non-energy efficient space-heating units presently in use with energy efficient space heating units. For existing buildings in Georgia, installing energy efficient space-heating units in high-rise residential and commercial buildings could reduce energy consumption by approximately 3-5% and GHG emissions by about 1.5–3.0%.

(vi.) Installing double glazed PVC framed windows and doors in existing high-rise residential and commercial buildings in Georgia could reduce existing energy consumption volume approximately by 15-19% and GHG emissions by about 9-13%.

It will also be possible to implement some aspects of "greening" by implementing innovative engineering solutions for this stock of existing buildings. Suggested solutions that could be implemented in this category include:

(i.) Construction of green roofs and introduction of urban agriculture/horticulture on the roofs of these buildings.

(ii.) Installation of rainwater harvesting units for communities of high-rise, multi-story buildings.

(iii.) Introducing domestic waste sorting and recycling schemes. The domestic waste could be separated into biodegradable and non-biodegradable waste. The biodegradable waste could be composted into green manure, and the non-biodegradable waste could be further separated into metals, plastics and other domestic waste. The other forms of domestic waste could be cleaned, sorted, packed, and sold for recycling.

(iv.) Introducing a city-wide tree planting (carbon sequestration) scheme and linking the sustainability ratings of existing buildings to the carbon sequestration scheme. This could be done by linking preset building sustainability points which could be earned by existing buildings by the planting of a set number of trees. These trees could be planted in selected areas of the town or city where the building is located. The carbon sequestration effects (equivalent to GHG emission reductions) of the planted trees could then be linked to the sustainability of the specified building. This concept could be implemented in the first version of the buildings performance rating scheme for existing buildings in Georgia.

Figure 15: Tbilisi is surrounded by hills which are mostly barren. A tree planting (carbon sequestration) scheme has potential to improve air quality

2.3 Post Soviet Era (1990 – Present)

The collapse of the Soviet Union marked the advent of the Post-Soviet building construction era in Georgia. According to Levan Natadze, the main effect on the building construction sector was that building and environmental regulations were no longer enforced. The standardized construction codes and Soviet Era regulations, though still in the statute books, have been neglected and diversified architectural concepts have been introduced. Capitalism was introduced into the building construction industry and marketing of constructed buildings now forms a main consideration in the building construction industry.

Figure 16: Newly (2012) constructed block of high-rise apartments

Environmental and sustainability parameters are no longer given high priority in the design and construction of buildings. Greater importance is placed on the outer appearance of buildings to enhance salability, rather than on the technical performance, including energy efficiency, of the structure. As a result, some buildings constructed in this era become too cold during the winter and need more energy to keep them warm and comfortable. Other buildings suffer from damp conditions and dry rot. These are issues which were not observed in buildings constructed during the Soviet Era.

The majority of buildings constructed during this era are designed as reinforced concrete frame and slabs. Thin cement and sand blocks are used to construct internal and external walls. While Georgia has ratified the Commonwealth of Independent States (CIS) interstate construction codes = on thermal protection of buildings, enforcement of this standard is nonexistent. Some consequences of the absence of unified building codes, as well as the introduction of commercialization into the building construction subsector of the Georgian economy, are a huge decrease in thermal quality of construction, as well as the technical components of buildings. New constructions of residential, non-residential, and public buildings have all suffered from a drop in technical quality.

For example, the external walls of multi-floor commercial and residential buildings constructed in this era have decreased from about 40cm to an effective value of less than 10cm. While the measured thickness of external walls could range from 20 cm to 30 cm, the effective thermal component of the external wall is actually less than 10cm. This is because hollowed sand and cement blocks are used in the construction of the external walls. This has reduced the thermal properties of the external walls to less than a quarter of those provided by the external walls of buildings constructed in the post-Stalin era (1956-1990)—the Soviet Era sub-period with the worst thermal performance for buildings.

Figure 17: Core and shell construction techniques are commonly used in building construction in the Post-Soviet Era.

The core and shell of a multi-floor apartment building under construction can be seen in the above photograph (left). The photograph on the right shows a close-up of another modern multi-floor construction.

The external walls are designed to be 20cm thick; however, the effective thermal mass of the external walls is only about 12cm, as a consequence of their construction using hollowed sand and cement blocks.

Figure 18: Reduced external wall thickness is a major characteristic of building constructions in the post-Soviet Era.

The introduction of a market-driven approach in building construction during this era has resulted in the following prevailing building features:

(i.) Shell and core construction methodology for multi-story buildings is now the norm. Reinforced concrete is used to construct loadbearing beams. External walls are constructed of hollow cement bricks and the external wall thicknesses are reduced to about 10-12cm. In a technical sense, the thermal mass of these walls is less than a third of that of external walls constructed during the Stalin Era (1937-1956).

(ii.) Reinforced concrete used for floors and ceilings

(iii.) Single glazed metal or wooden windows

(iv.) Metal framed doors with metal panes

(v.) Horizontal concrete framed roofs

(vi.) Open staircases have been standard, although enclosed staircases are now being constructed (2002-Present) as a more attractive option.

(vii.) No attics are constructed.

(viii.) No conservatories are included in the building constructions.
Basements serve as multi-purpose garages. Therefore no proper care is given to thermal comfort of basements. No floor tempering is included in the construction to provide floor insulation for the basements of multi-story buildings.

From an energy efficiency perspective, due to the low thermal mass of buildings constructed in the post-Soviet Era, these buildings are very "energy-hungry," requiring high energy volumes to ensure year-round comfort. Continuation of this type of construction is not recommended for Georgia in the context of its energy efficiency and GHG emission reduction goals.

As a result of the low effective thermal mass of the external walls of post-Soviet Era buildings, assessment with the proposed Georgian GB rating and certification scheme would yield low scores for GB parameters such as Indoor Environmental Quality, Energy, Onsite Environment, Reduced Emissions and Pollution, Innovation, and Health and Well-being, if these parameters are included in the Georgian GB rating and certification scheme. Low scores on six out of fifteen GB parameters could translate into a sizeable percentage of Post-Soviet buildings failing to achieve a favorable GB rating.

It is worth mentioning that there is a subgroup of eye-catching public and privately-owned buildings constructed in recent years that are constructed with external glass envelopes from floor to ceiling. Examples of public buildings that fall in this category are police stations, which are normally low-rise structures of about 2–3 floors. Privately-owned buildings that fall in this category include high-rise hotels. These are designed and constructed as high-value properties focused on outward appearance, and command top range prices in the property market in Georgia. Such buildings have extremely low thermal performance components, requiring huge quantities of energy to keep occupants warm during winter months and cool during summer months.

From a green buildings perspective, these structures have extremely high energy and environmental footprints and would rate low on GB parameters such as Indoor Environmental Quality, Transportation, Materials, Energy, Onsite Environment, Reduced

Emissions and Pollution, Innovation, and Health and Well-being, if these parameters are included in the Georgian GB rating and certification scheme. Receiving low scores on eight out of fifteen GB parameters could translate into these high profile buildings failing to achieve a favorable GB rating.

According to Levan Natadze, as a result of the newly introduced concept of "legislative simplification," no environmental regulations are currently implemented in the construction of modern buildings in Georgia. An environmental impact assessment study is required only for large-scale industrial developments. The concept of energy use in buildings is not given any priority in building design, construction, or operation.

2.4 Energy Performance of Existing Buildings in Georgia

The existing building stock in Georgia is characterized by very low energy performance. The thermal performance of the building matrices in Tbilisi are 3-4 times lower than the recommended values for building thermal energy performance for the Tbilisi climate zone (Matrosov Y. et al., 2008). This is primarily a result of the thin outer walls of buildings constructed during the post-Soviet Era.

Levan Natadze states that, on average, buildings in Georgia use 30-45% more energy for heating per square meter of floor space than buildings in EU countries with the same climate conditions. Residential, commercial, and public buildings in Georgia with concrete exterior walls less than 300mm thick and single glazed windows consume more than 60% of the total primary energy in Georgia (Matrosov Y. et al., 2008). Buildings in Georgia constitute the largest source of GHG emissions.

According to the Georgian State Department of Statistics, the country's construction sector had a turnover of 1.61 billion GEL (about $961.481 million) in 2006, compared to 243 million GEL (about $145 million) in 2001. This shows the very fast rate of growth in the building construction sector of the economy. Should construction continue at this pace with the currently existing thermal performances, GHG emissions associated with buildings will continue to grow.

2.4.1 External walls and building thermal performance

As noted earlier, construction companies in Georgia use the frame and block method of construction and low-quality concrete blocks or hollow cement blocks are typically used as building materials for external walls. In new buildings in Tbilisi, the thickness of the exterior walls is 10-25cm, but the effective thermal mass of the external walls is actually 10-12 cm. The thermal conductivity properties of the external walls range between 0.6 W/m ^{O}C and 0.7 W/m ^{O}C. (These values are estimates obtained from local architects, because there are no laboratories in Georgia to determine the important building construction indices for construction materials.)

In accordance with the EU Energy Performance of Buildings Directive, the construction of buildings with such low thermal performances for external walls was phased out in European Union countries in the early 1990s (IPF, 2007).

The thermal performance of existing buildings can be improved by augmenting the thermal performance of their external walls. This can be done by adding insulation to the external walls and installing double or triple glazed energy efficient window and door units (Matrosov Y. et al., 2008). It is estimated that it is possible to achieve a 45-50% reduction in building energy demand (with commensurate GHG emission reductions) in the average Georgia building stock through the installation of proper building envelope measures (e.g., façade insulation, window glazing). For new buildings, it is hoped that the proposed Georgian building construction code will introduce thermal performance standards for external walls of new buildings. Thermal insulation can be the most cost-effective way to reduce GHG emissions associated with building operations in Georgia.

2.4.2 Types of Fenestration and Glazing

Double glazed, single-sash windows are commonly used in post-Soviet buildings in Georgia. Common materials used for frames in such windows are metals and polyvinyl chloride (PVC). Metal and PVC window frames are produced by local companies, including advanced companies such as Interplast.

The installed double glazed windows are not as energy efficient as standardized double framed (PVC framed) windows constructed according to CE standards.[1] No glass with low-E coating is available in the Georgian construction market. A survey of construction companies conducted by GBC-G in 2011 showed that, in Tbilisi, out of twelve construction companies interviewed, only one construction manager was aware of the existence of low-E coated glass.

This indicates lack of awareness and emphasizes the need to educate architects, engineers, and other building stakeholders on modern construction methods and energy efficient material availability.

2.4.3 Heating Systems for Indoor Quality

Until the early 1990s, district heating (DH) systems that supplied space heating and domestic hot water were available in many urban areas in Georgia. After the declaration of Georgian independence in 1990, as Russian fuel supply diminished and was finally exhausted, district heating boiler plants gradually stopped functioning and were later stripped.

Presently, the entire municipal or district heating network in Georgia is non-functional. Residential apartments in multi-family and multi-level buildings in Tbilisi use inefficient and unsafe heating technologies. According to officials of the Tbilisi Municipal Council, provision of safe and economically viable space heating units for the urban population is a top priority. The development of efficient residential heating systems is a key component of improving building energy efficiency in Georgia.

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[1] CE marking indicates that a product conforms to legal requirements in specific European technical standards known as harmonized European Norms ('hEN'). It enables a product to be placed legally on the market in any European member state. However, regulatory requirements may differ from country to country. The CE marking symbol is placed on either the product or the packaging accompanying the product.

2.5 Building Construction Code in Georgia

The population of Georgia stands at about 4.2 million with half of the population residing in cities. About 1.2 million people live in the capital city, Tbilisi. Information from the urban design department of the Tbilisi City Municipality indicates that about 6.5 million square meters of multi-story residential buildings were constructed over the last three years.

Residential buildings in Georgia account for about 103 million square meters of building envelopes. The number of single family buildings available is about 670,000-700,000 units, accounting for about 73 million square meters of housing units. It is important to point out that in Tbilisi, about 15% of the population resides in modular apartments, also referred to as single-family homes; in Batumi (the third-largest city in Georgia) approximately 40 % of the total residential buildings are single-family homes.

There is no Georgian national building construction code, but in the construction of buildings, consideration is given to structural stability. This is because Georgia is located in a seismically active zone. Old Soviet-style codes for structural stability are used for engineering calculations. The old Soviet codes for thermal engineering of buildings are only used on a voluntary basis.

In Tbilisi, permitting for construction of new buildings is based on the following three-stage application process through the Urban Planning Department of Tbilisi City Hall:

2.5.1 Stage 1: Submission of required documents

Specific building construction documentation is submitted to the Urban Planning Department of Tbilisi City Hall. The required documents include:

- (a.) An application that includes the description and intended purpose of the building;
- (b.) Public Land Registry Certificate and cadastral Map to confirm the spatial location of the property;
- (c.) Topography maps, 1:500 and 1:2000;
- (d.) Photographs showing the position of the land and relationship with neighboring structures; and
- (e.) Certificate of land ownership and/or notarized agreement of the co-owner.

2.5.2 Stage 2: Application

During the second stage, the responsible officer at Tbilisi City Hall sends written acknowledgement of the receipt of documents required for stage one. The following materials must be submitted to the Tbilisi City Hall:

- (a.) Cadastral map of the land area and a Public Registry Certificate;
- (b.) Architectural-building design;

(c.) Section of Administrative Act (passed by the Town Hall) relating to the specific plot of land, vis-à-vis town planning structure and condition;
(d.) Engineering studies for the building project; and
(e.) Geological studies for the building project.

2.5.3 Stage 3: Consultation

At the conclusion of the second stage, a meeting is held between the main sponsors of the building project and the Urban Planning Department of Tbilisi City Hall to discuss all aspects of the construction project. Upon satisfactory conclusion of this meeting, the Urban Planning Department of Tbilisi City Hall provides approval of the building's architectural design.

Following acceptance of the architectural design, the following documents are submitted to the Urban Planning Department of Tbilisi City Hall:

(a.) Architectural-building design;
(b.) Layout drawings;
(c.) Technical conditions obtained from the local utility suppliers including TELASI (electricity), Tbilisi Water company (water network) and Kaztransgas (gas supply network); and
(d.) Cadastral map and certificate of the land as produced by the Public Lands Registry office.

In circumstances where the building is of special importance -- for example, in the construction of museums, theaters, or airport buildings -- a report on the suitability and compliance of the building is required to be submitted with the application. After the third stage, the building permit is issued within ten days.

2.6 Value Chain for Buildings in Georgia

Different factors influence the price of constructed buildings and the cost of construction in post-Soviet Georgia. One of these factors is the building location. The closer the building is to town or city centers, the more expensive it will be. Another factor is the quality of the building's finishing.

In addition, there are numerous administrative and professional fees involved in constructing buildings in Georgia; these are listed in Table 12.

	Item	**Price Range ($/m²)**	**Comments**
1.	Land	50-5,000	The price of land depends on the location. The closer a building is to town or city centers, the more expensive the land.
2.	Architect to prepare the plan	10-20	These price ranges are similar for

			different parts of Tbilisi and Batumi
3.	Legal fees	2-20	" "
4.	Electrical design	2-5	" "
5.	Structural designs	3-5	" "
6.	HVAC design	2-4	" "
7.	Quantity surveys	1-1.5	" "
8.	Landscape consultant	3-20	This service is normally contracted for upscale customers in the most expensive areas of Tbilisi and Batumi
9.	Sewage design	1-2	These price ranges are similar for different parts of Tbilisi and Batumi
10.	Low voltage design – for security, alarms, etc.	1-1.5	" "
11.	Geophysical/geologist consultancy and report	5-10	" "
12.	Environmental Impact Assessment (EIA) identifies environmental or ecological hazards and recommends remediation routes	2-5	" "
13.	Approval from Municipality	-	In the event that the construction exceeds the size authorized, fines are levied.
14.	Construction supervisor	3,000-3,500	Monthly salary

Table 12: Administrative and professional fees and other building and construction costs in Georgia

Figure 19: Georgian Building Construction Supply and Value Chain

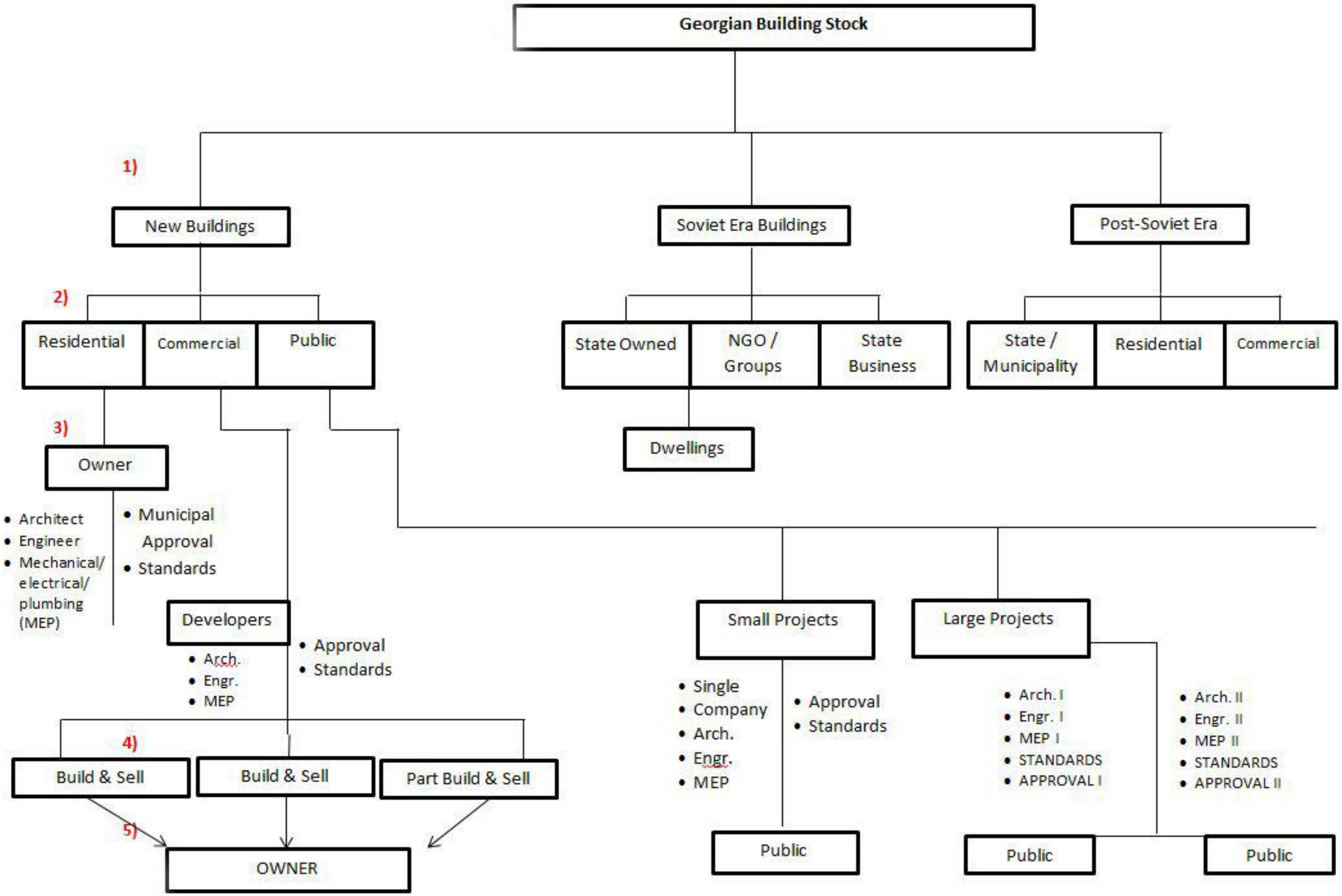

Figure 19 shows the different levels wherein building construction is impacted in the Georgian construction supply chain. The cost-drivers and the institutions (professional or administrative) responsible for them are summarized in Tables 13-17.

LEVEL	ACTIVITY	INSTITUTIONAL INTERVENTIONS
1.	• Land is bought for the construction of new buildings. • An existing building could also be bought for renovation.	**<u>MUNICIPAL ADMINISTRATION & LAW FIRM CHARGES</u>** • Land purchase • Land registration • Certificate of land ownership • Purchase of existing building for renovation • Building ownership documentation

Table 13: Administrative and professional charges involved during land purchases

The administrative and professional charges involved in the land or old building purchase stage of new buildings construction or building renovation in Tbilisi are shown in Table 13.

LEVEL	ACTIVITY	INSTITUTIONAL INTERVENTIONS
2.	Building permit application (Refer to sections 3.5.1 – 3.5.2)	**<u>MUNICIPAL ADMINISTRATION, LAW FIRMS & PROFESSIONAL CHARGES</u>** • Building permit application costs • Description of building occupancy • Spatial map of the land or property • Topographic map of the land or property • Photographic evidence • Notarized land/property ownership certificates • Cadastral map of the land area and a Public Registry Certificate • Architectural-building design • Section of Administrative Act (passed by the Town Hall) relating to the specific plot of land, vis-à-vis town planning structure and condition • Engineering studies for the building project • Geological studies for the building project

Table 14: Administrative and professional charges involved during Stages 1-2 of the building permit process

The administrative and professional costs incurred by the developer during the first and second stage of the building permit application process in Tbilisi are shown in Table 14.

LEVEL	ACTIVITY	INSTITUTIONAL INTERVENTIONS & COSTS
3.	Building permit Consultation (Refer to section 3.5.3)	<u>Costs involved:</u> • Architectural-building design • Layout drawings

		• Technical conditions obtained from the local utility suppliers including TELASI (electricity), Tbilisi Water company (water network) and Kaztransgas (gas supply network) • Cadastral map and certificate of the land as produced by the Public Lands Registry office

Table 15: Administrative and professional charges involved during stage 3 (consultation) of the building permit process

The administrative and professional costs incurred by the developer during the third stage of the building permit application process in Tbilisi are shown in table 15.

LEVEL	ACTIVITY	INSTITUTIONAL INTERVENTIONS & COSTS
4.	Construction	In Tbilisi, construction costs range between $\$300/m^2$ - $\$500/m^2$.

Table 16: Administrative and professional charges involved during the construction process

The cost range for constructing a two-bedroom apartment in an average neighborhood in Tbilisi is $\$300/m^2$ - $\$500/m^2$.

LEVELS	ACTIVITY	INSTITUTIONAL INTERVENTIONS & COSTS
5.	Sale of building either as core and shell or as completed building	All costs involved are borne by the purchaser. Building normally sold at a value ranging between 8-10 times the cost of construction

Table 17: Building sale process

The constructed building can be sold as core and shell (without finishing). The cost of such a core and shell structure for a two-bedroom apartment is between $\$400/m^2$ and $\$800/m^2$. Costs for finishing a core and shell structure vary according to the taste of the owner and could range between $\$200/m^2$ and $\$500/m^2$. It is also possible to sell completed apartments. For a two-bedroom apartment located in an average (middle class) neighborhood of Tbilisi, complete with all finishing, the price ranges between $\$1,000/m^2$ and $\$5,000/m^2$.

2.7 Profit Margin for Building Construction in Georgia

As noted above, the real estate business in Georgia is very profitable. For this reason, many international investors are entering the Georgian construction market for residential and commercial buildings.

According to Ministry of Economy and Sustainable Development officials, Arab businessmen are considering investing as much as $200 million in construction of elite residential complexes in Tabakhmela and Tsavkisi, two areas located close to the center of Tbilisi. In addition, Israeli investors plan to spend some $100 million on residential buildings construction.

According to the Information Department of the Tbilisi municipal government, another significant investment is expected by Korean investors on Elia Mountain, a less populated area within walking distance of Tbilisi's historic center. Within the city government, officials say that they see no end in sight for the Georgian capital's construction boom, and concede that the building frenzy could well change the city's skyline.

The timing is therefore excellent for the EC-LEDS Clean Energy Program to liaise with the Tbilisi and Batumi municipal governments to ensure that a good building envelope matrix, EE, RET solutions, and GB concepts are implemented in buildings constructed in Tbilisi and Batumi. Due to the very high profit margin presently existing in the building construction industry, it would be possible to implement these innovations without discouraging investors in the sector.

2.8 Green Building Construction Materials in Georgia

Georgia has sufficient local construction materials, such as cement, sand, rock aggregates, and gravel. The country produces construction products for local needs such as gypsum board, foam plastic, sandwich wood panels, and perlite construction blocks/bricks.

Steel (rods and sheets) for building construction is mostly imported from Ukraine. Finishing materials for buildings, including glass and formed PVC plastics for doors and windows, are mostly imported from Turkey and Iran. A few companies, including GBP Ltd., transform basalt rock into basalt fiber, mat, and wool. Wood Service also trades in wood construction materials. The quantity of thermal insulation materials manufactured in Georgia is not sufficient for the local market; therefore some of these materials are imported from Turkey and Iran. The prices for these major items influence the cost of construction.

There are very good opportunities to improve the energy efficiency of buildings in Georgia by using new technologies. Some EE and RET solutions which could be implemented in the existing building stock in Georgia have already been presented in section 1.3. Sustainable construction (green buildings) materials that are available in the Georgian building construction market include:

(a.) Roofing materials;
(b.) Baked bricks for construction of walls;
(c.) Granite and volcanic stones for constructing basement and ground floor walls;
(d.) Crushed rocks for pavement, indoor flooring, and outdoor flooring;
(e.) Basalt rock-wool; and
(f.) Perlite materials.

Imported building construction materials come with certificates from foreign manufacturers. This is part of the required documentation for importing these materials into Georgia. Local construction products are certified by the Georgian Certification Authority. About 1,200 certificates are issued per year for exploration of construction materials such as sand, stone-aggregates, and other earth minerals.

However, local GB construction material certification schemes for manufactured GB construction components do not exist. The existing certification authority needs support to rate and certify manufactured GB construction materials and to upgrade their methodologies to international standards.

The implementation of a voluntary GB rating and certification scheme in Georgia will drive forward the market in GB construction materials. It will also encourage the creation of rating and certification schemes for different types of manufactured GB construction materials. Examples of GB certification schemes that can evolve from the emergence of a GB rating and certification scheme are certification schemes for:

- (a.) Building construction wood;
- (b.) Double and triple glazed windows;
- (c.) Mineral roofing materials;
- (d.) Oven-baked bricks;
- (e.) Construction recycling products;
- (f.) Crushed rocks for construction;
- (g.) Basalt rock-wool; and
- (h.) Perlite materials.

Should the proposed Georgian GB rating and certification scheme adopt a point rating system per parameter, then by using certified Georgian-manufactured GB construction materials like wall insulation, PVC framed and vacuumed double or triple glazed windows, doors or other building-openings, assessed buildings would further improve their ratings with regards to the following GB parameters: Materials, Innovation, Sourcing of Materials, Transportation, Reduced Emissions and Pollution, and Health and Well-being, if these parameters are included in the Georgian GB rating and certification scheme. By obtaining high scores in six out of fifteen GB parameters, buildings that use Georgian-manufactured GB construction materials could gain top GB ratings through the proposed scheme.

The installation of properly certified double glazed windows with low-E coatings has the potential to improve the energy ratings of buildings by about 40% and add thermal comfort. The use of a combination of double glazed window units with low-E coatings and modified polystyrene-concrete blocks would improve the energy efficiency of buildings by more than 50%. Implementation of such measures would upgrade the operational ratings of post-Soviet Georgian buildings and would help Georgian buildings comply with the European Union Directive 2002/91/EC on the Energy Performance of Buildings.

Georgia will depend on international certification schemes for the foreseeable future for building construction materials relating to building services. These include certification and standards for:

- (a.) Energy efficient lighting units;
- (b.) Electric or gas heaters and radiators for space heating;
- (c.) Domestic hot water (DHW) units;
- (d.) Construction recycling products;
- (e.) Crushed rocks for construction;
- (f.) Basalt rock-wool; and
- (g.) Perlite materials.

If the proposed Georgian GB rating and certification scheme adopts a point rating system whereby buildings are graded by the number of points which they score for each GB parameter, then by using efficient lighting, space heating and DHW units, post-Soviet buildings assessed by the scheme would further improve their ratings with regard to GB parameters like energy, innovation, reduced missions and pollution as well as health and well-being if these parameters are included in the Georgian GB rating and certification scheme.

2.9 Market for Green Buildings and Construction Materials in Georgia

Buildings that fall under the classical definition of green buildings are not presently constructed or sold in Georgia. Furthermore, there is no legislative incentive to construct green buildings in Georgia. Strong focus on implementing the new building code would provide incentive to construct green buildings.

It is difficult to properly gauge the market for green building construction materials in Georgia, since no studies have been carried out to systematically appraise the market for sale and purchase of green buildings construction materials. A few companies exist in Tbilisi that trade in green buildings construction materials. These include:

(a.) Wood Service – trades in wood products for building construction;
(b.) Euro-building – trades in pumice-concrete blocks; and
(c.) Interplast – manufactures and trades in freeze-dried foamed polystyrene for wall insulation

Other, smaller Georgian companies assemble double glazed windows with PVC frames. However, the lack of any certification scheme for manufactured green buildings construction materials in Georgia means that the effectiveness of these materials cannot be ascertained. A cursory estimate indicates that the building construction market share of companies that trade in green buildings construction materials is less than 5% of the building construction materials market.

To support the green buildings industry in Georgia generally and the GGBRCB specifically, it would be advantageous for the EC-LEDS Clean Energy Program to consider supporting a scheme to standardize green buildings construction materials in Georgia.

SECTION THREE: RECOMMENDATIONS FOR DEVELOPING A GREEN BUILDING RATING AND CERTIFICATION SCHEME IN GEORGIA

In this section, recommendations are presented for designing and implementing a GB rating and certification scheme in Georgia.

3.1 Developing a Green Building Rating and Certification Scheme for Georgia

Many academic studies (Upstream, 2003; Pett et al., 2004) have argued that there is a "business case" for sustainable development—including green building construction—as a result of the evolution of national planning policies, particularly in transitioning economies such as Georgia. Furthermore, standards provided by European Union (EU) directives (e.g., the Energy Performance of Buildings Directive (EPBD) (IPF, 2007))are increasingly being adopted by many of these emerging countries.

Presently in Georgia, a construction code is in the initial stages of development. This code will set requirements for some building components relating to EE and GB concepts. In the interim, a voluntary scheme for a Georgian green buildings rating and certification scheme would play a vital role in raising awareness about GB concepts and their application in Georgia.

A main objective of the proposed green buildings rating and certification scheme for Georgia would be to achieve comparability with some of the main existing green buildings rating and certification schemes in the world. This means that a building in Tbilisi assessed using the proposed green buildings rating and certification scheme for Georgia should obtain an equivalent score as it would if it were assessed and rated using a scheme such as LEED or BREEAM.

The proposed green buildings rating and certification scheme for Georgia should offer transparency, compatibility, and reliability to users, assessors and other stakeholders (such as investors, building owners, and tenants). The system, however, should also provide opportunities to adjust categories for particular regional characteristics (e.g., earthquake resistance is taken into consideration in the CASBEE rating and certification tool for Japan) or special climatic requirements (e.g., rainwater harvesting, which prominently features in the German DGNB rating and certification tool).

All of the existing green buildings rating and certification schemes include relatively similar parameters and indicators (BRE, 2004). It is recommended that the parameters chosen for inclusion in the Georgian green buildings rating and certification scheme be drawn from the fifteen parameters listed in Table 4, with enhanced consideration given to unique geophysical and environmental factors specific to Georgia. These include the fact that Georgia is located in a geologically active zone, and that many Georgian cities (e.g., Tbilisi) are characterized by irregular geophysical and spatial planning.

Other important factors to be considered when designing a Georgian green buildings rating and certification scheme include:

(a.) Fuel type for electrical energy generation in Georgia: The type of fuel used in the generation of electricity determines the quantity of GHGs emitted by building services (for existing buildings). For new buildings, during the construction stage of the building, an assessment of the potential for on-site energy generation should be considered. During the occupancy stage of the building, the operational energy demand for all buildings should be determined.

(b.) Simplicity of operation of the green buildings rating and certification scheme: The level of complexity of existing rating and certification schemes varies widely. For example, the Green Globes assessment tool used in Canada and the United States (U.S.) uses a "streamlined online approach" that utilizes an online questionnaire to generate a green building rating and certification report (Green Globes 2009). On the other hand, Schendler and Udall (2005) have argued that the energy modeling process adopted by LEED is "fiendishly complicated" and the assessment process crippled by bureaucracy.

The proposed green building rating and certification scheme for Georgia should be designed with simplicity of operation in mind, particularly since Georgia still lacks personnel and supporting infrastructure for energy auditing, as well as energy and environmental surveillance.

One recommendation for Georgia could be that the GB rating and certification scheme should initially be designed to accommodate existing buildings and new buildings separately. The rating and certification of existing buildings (residential, non-residential, and public buildings) could be similar to the Energy Performance Certificate (EPC) procedure practiced in England under the BREEAM rating and certification scheme.

For new buildings, the first version of the Georgian scheme (for homes) could use an online assessment protocol for generating the rating and certification report. This would be similar to the process utilized by the Green Globes rating and certification scheme operated in Canada and parts of the west coast of the US.

(c.) The cost to have a building rated and certified under the scheme: Any rating scheme will achieve market penetration more quickly if it is not too expensive. For example, the maximum certification fee for the German DGNB (2009) scheme is €12,000.00 (€15,000.00 for non-members of the scheme) while the fee for LEED (new construction, 2003) can be as high as €35,000.00 (€48,000.00 for non-members).

In this regard, Schendler and Udall (2005) have argued that the LEED assessment tool is prohibitively expensive, which has led to designers and owners being increasingly driven by scoring points in order to obtain the maximum rating, rather than by designing sustainable buildings for a particular site and use.

In most countries where green building rating schemes exist, the maximum acceptable extra cost is defined by end-user type, starting from 1% in Russia for public buildings to 12% in Australia. (Ebert et al., 2010).

A recommendation for Georgia could be that the assessment, rating, and certification of existing buildings should be priced between 1% and 3% of the current market value of the house. For new buildings, studies should be carried out to ascertain that the incorporation of GB concepts in any new construction, as well as the assessment, rating, and certification of the building upon completion, would not increase the construction cost by more than 10% of the cost if the building were constructed without GB components.

3.2 Proposed First Version of the Georgian Green Buildings Rating and Certification Scheme

The first version of the Georgian green building rating and certification scheme (GGB-Version 1) should focus on existing buildings (residential, non-residential, and public buildings). This version should be designed to reflect the simplicity of the operational methodology of the existing-building EPC certification scheme presently in operation in the UK, Northern Ireland, and the Republic of Ireland.

Two other advantages of the EPC operational methodology are as follows:

(a.) It is fully compliant with the requirements of the EU Energy Performance of Buildings Directive (EPBD) (BRE 2004); and

(b.) It utilizes specialized computer software to analyze all environmental parameters required for rating and certifying existing buildings. One benefit of using this type of computer software is that it introduces greater mathematical accuracy in the calculations, rating, and certification procedures. Another benefit is that it reduces errors inherent in rating and certification processes that rely only on human assessment.

Data on the following building components are logged into the software program through interfaces, such as keyboards or touchscreens:

(a.) Building envelope matrices, including walls, roofs, and ceilings;
(b.) Building orientation;
(c.) Glazing type;
(d.) Glazing percentage;
(e.) Air permittivity;
(f.) Electrical energy consuming equipment;
(g.) Occupancy density;
(h.) Gas/other consuming equipment;
(i.) Domestic hot water equipment; and
(j.) Innovative technology or RET installed

Upon complete input of all required building components, the software runs the calculations, generates certification levels for the existing buildings, and provides the score for each building.

It should be noted that rating and certifications for existing buildings relate only to the GHG emissions and environmental impact of the building during its operational phase.

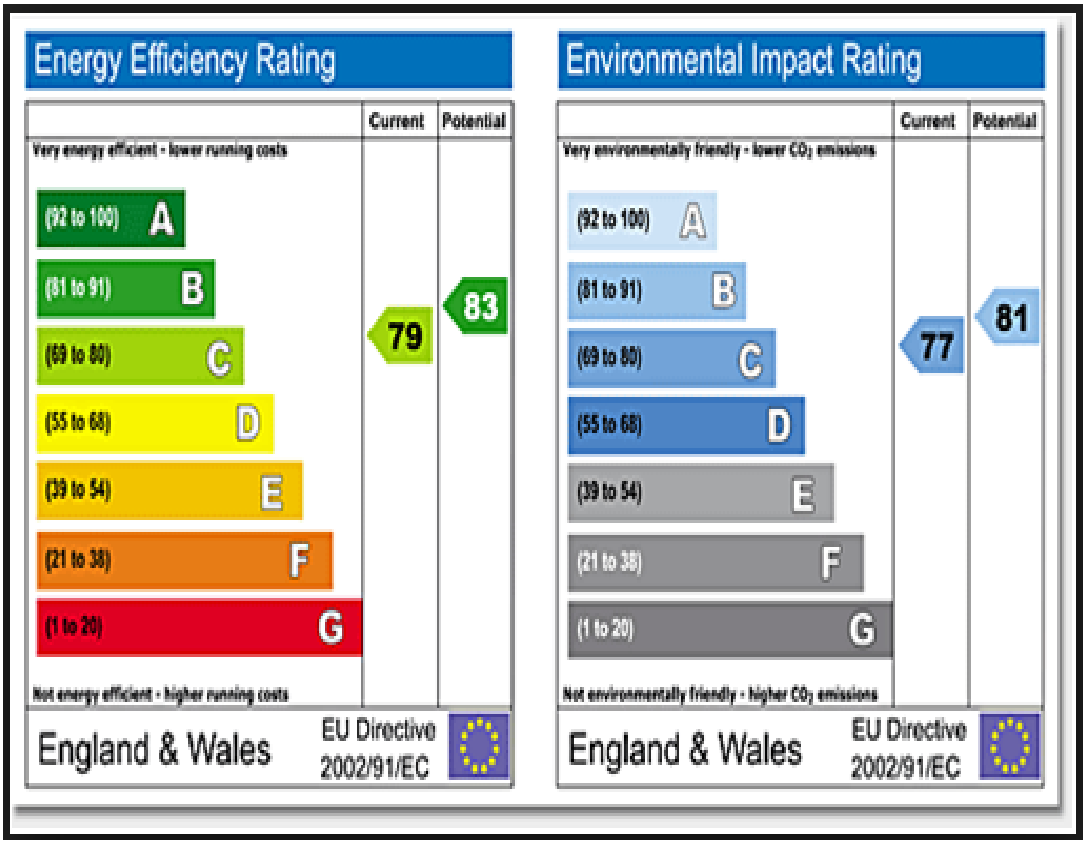

Figure 20: Building rating certificates for existing buildings in England

Figure 20 shows a rating certificate for existing buildings (DCLG, 2009). On the left is a presentation of the energy efficiency (operational) rating of the building. On the right is a presentation of the environmental impact rating of the building. This is obtained by assessing the building's operations against pre-determined GB parameters. Examples of these GB parameters for existing buildings include Management, Site Sustainability, Indoor Environmental Quality, Quality of Service, Outdoor Environment, Water, Transportation, as well as Health and Well-being. The building scores points for each of the GB parameters and the sum of these points determines the rating of the existing building.

An EPC-tailored methodology for the Georgian GB rating and certification scheme would be suitable for rating and certifying existing buildings in Georgia. This type of system could:

(a.) Serve as a register of existing buildings in Georgia;
(b.) Act as a tool for obtaining baseline GHG emissions and baseline environmental impacts for existing buildings;
(c.) Progressively demonstrate GHG emissions reductions associated with EE & RET improvements in existing buildings; and

(d.) Serve as a database of customized recommendations for improving the buildings' operational ratings.

Presently in the UK, there exist several proprietary software programs used to generate EPCs. They include TAS, IES, HEVACOMP, and DesignBuilder. All of these software programs are designed to be compatible with a government licensed software interface called Simplified Building Energy Model (SBEM).

The UK government, through its Department for Communities and Local Government (DCLG), commissioned the Building Research Establishment (BRE) to produce a software tool capable of analyzing the energy consumption of buildings. SBEM is currently used to determine CO_2 emission rates for new buildings in compliance with Part L of the Building Regulations (England and Wales). Modified versions of the SBEM tool are now in use in Cyprus, Gibraltar, and Mauritius, and developments are underway for other countries, initially in Europe ("BRE Group: SBEM"). Georgia could investigate the possibility of using a modified version of SBEM for its GB rating and certification scheme.

SBEM is linked to the National Calculation Methodology (NCM) for analyzing EE as well as the environmental impact of existing buildings. SBEM contains a library of building components for hundreds of different building types. All of the different types of proprietary software programs listed above are NCM compliant by law (DCLG 2009). To satisfy this regulatory requirement, all other proprietary software programs listed above key into SBEM, where they are linked to the NCM database for analyzing different types of buildings.

Whereas SBEM is used in the UK for determining energy efficiency for non-residential buildings, modified versions of the tool as used in Cyprus enable it to be used to determine energy efficiency and environmental impact of residential, non-residential, and public buildings. Such modifications could be adopted for the Georgian GB rating and certification scheme. It is highly recommended that a team of Georgian information technology (IT) and buildings engineers be hired to develop a uniquely Georgian rating and certification software tool which can perform similarly to SBEM.

All of the software programs listed above perform the same function, which is to determine the energy efficiency and environmental impact of buildings. However, their interface, meaning how the software is designed for ease of human-machine interaction, differentiates one proprietary software from another. Of all the proprietary software presently in existence, one of the most user-friendly which could be utilized in a modified format in Georgia is DesignBuilder.

DesignBuilder is described by its owners as "a state-of-the-art software tool for checking building energy, carbon, lighting and comfort performance." This software simplifies the process of building simulation, allowing users to rapidly compare the function and performance of building designs and deliver results on time and on budget. DesignBuilder combines rapid building modeling and ease of use with state of the art dynamic energy simulation. Its innovative productivity features allow even complex buildings to be modeled rapidly by non-expert users.

3.3 Recommended Steps for Creating a Green Buildings Rating and Certification Scheme in Georgia

The following steps are recommended for setting up a green buildings rating and certification scheme in Georgia.

3.3.1 Developing a register of individual and professional groups of green building stakeholders in Georgia

Since the proposed green buildings rating and certification scheme in Georgia is conceived to operate on a voluntary basis, involvement of a broad spectrum of stakeholders in the building industry is an important prerequisite.
Identifying and engaging these stakeholders will ensure that every trade or professional group with interest in the building industry in Georgia, as well as the building value chain, is involved and/or represented in the proposed Georgian green building rating and certification scheme.

The types of stakeholders to be identified, contacted, and engaged in the process of setting up a green buildings rating and certification scheme for Georgia should include:

- (a.) Planning Unit of the Local Council;
- (b.) Architects;
- (c.) Land surveyors and land assessors;
- (d.) Landscape consultants;
- (e.) Condominium associations;
- (f.) Quantity surveyors for construction processes;
- (g.) Construction supervisors;
- (h.) Buildings construction related engineers (e.g., civil, structural, mechanical, plumbing, heating and ventilation);
- (i.) Low voltage design engineers for building security and emergency lighting systems;
- (j.) Environmental assessors/environmental impact consultants;
- (k.) Water utility consultants, water and sewage design consultants;
- (l.) Geophysical consultants and geologists; and
- (m.) Real estate agents and brokers.

In addition to these stakeholders, other building and construction related professionals can be identified and included.

Also to be identified, contacted, and engaged in this next step are professional associations, buildings-related trade groups, non-governmental organizations (NGOs), and small- and medium-sized enterprises (SMEs) involved in the building and construction process. These should include:

- (i.) Associations representing the list of individual professionals above;
- (ii.) Association of building and construction materials group traders;
- (iii.) SMEs involved in the building industry;
- (iv.) Representatives from the Tbilisi City Council;
- (v.) Representatives from other large City Councils in Georgia; and
- (vi.) Representatives from the government of Georgia.

For all individual and group stakeholders listed above, a registry should be created which contains individuals' or groups' names, contact details, nature of activity, size of operation, and business registration details (for groups and SMEs).

It may not be possible to cover all regions of Georgia in the initial stage of establishing a national green buildings rating and certification scheme and the Georgian Green Buildings Rating and Certification Board. However, it is recommended that, at minimum, the first stage of the process should engage stakeholders located in the largest and third largest cities in Georgia: Tbilisi and Batumi. Later in the stakeholder engagement process, other cities and towns throughout Georgia can be included.

The database in which names and contact details of individual and group stakeholders is held will constitute the GB register. This register of individual and group stakeholders should be continually updated throughout the project duration.

3.3.2 Creation of a Georgian Green Buildings Rating and Certification Board (GGBRCB) and its temporary executive bureau

The creation of the Georgian Green Buildings Rating and Certification Board (GGBRCB)[2] should be accomplished by convening a second stakeholder (working group) meeting. The meeting will decide to strengthen existing body (bodies) or to create a new one (ones) for these purpose. During the meeting, a temporary executive bureau (committee) for the GGBRCB should be constituted through selection and appointment of representatives of the key stakeholders listed in the stakeholder register (created in Step 1 above). The appointed officials should be chosen based on their professional experience, competence, and commitment to the process of establishing a green buildings rating and certification scheme in Georgia. After several months, it is envisaged that this temporary executive bureau will transition into a permanent executive bureau.

A chairperson would need to be selected to lead the temporary executive bureau of the GGBRCB. The chairperson would provide technical assistance and guidance to the temporary executive bureau of the Board, and ensure that key activities are accomplished during the bureau's tenure as a temporary body. It is recommended that someone from either Tbilisi City Council or from the central government of Georgia be nominated to fill this position. Such a nomination would provide the added benefit of lobbying leverage with the government of Georgia.

The types of individuals and entities tapped to participate in such new Boards are typically selected to provide: 1) input from technical experts related to the range of disciplines involved in the GB field, as well as 2) representation from key political, financial, and business entities from which guidance and buy-in are critical for a new GB scheme.

To ensure that the full range of expertise and influence is represented on the GGBRCB, it is recommended that the following individuals, on the basis of their skills, experience, and

[2] The name Georgian Green Buildings Rating and Certification Board (GGBRCB) has been carefully chosen to preclude conflicts of interest between the proposed body and existing organizations, and to differentiate the new Board from the Green Buildings Council of Georgia (GBC-G).

commitment to the proposed green buildings rating and certification scheme, be included as members of the temporary executive bureau of the GGBRCB:

(d.) Dr. Karine Melikidze of the Sustainable Development and Policy Centre (SADP- Centre)
(i.) Levan Natadze of the Green Buildings Council of Georgia (GBC-G)
(ii.) Kateryna Poberezhna of the Caucasus Environmental NGO Network (CENN)
(iii.) Dr. Zaal Kheladze of Wood Service
(iv.) Aleksandre (Sandro) Ramashvili, Architect, GBC member, Lecturer at Ilia University (teaching sustainable design to students of architecture)
(v.) Iuri Svanidze of the Georgian Society of Civil Engineers
(vi.) Giorgi Abulashvili of the Energy Efficiency Centre

It is also recommended that representatives of the following organizations be included in this temporary executive bureau of the GGBRCB:

(a.) Tbilisi City Council
(b.) Energy Innovative Group
(c.) Energy Efficiency Centre of Georgia
(d.) Georgian Institute of Buildings
(e.) Banks involved in EE financing
(f.) Universities
(g.) Practicing architectural firms
(h.) Practicing engineering firms
(i.) Real Estate Association of Georgia (GREA)

Other individual professionals or representatives of relevant groups, SMEs, or NGOs can also be identified and included as members of the temporary executive bureau of the GGBRCB. Criteria for selecting and including representatives into this body should include:

(i.) Highly skilled, experienced, and influential within the realm of his/her operations
(ii.) Expressed willingness to serve in the temporary working group

3.3.3 Creation of detailed terms of reference and expected deliverables for the temporary executive bureau of the GGBRCB

A detailed terms of reference, expected deliverables, and a timeline for achieving the deliverables should be identified and presented to the temporary executive bureau of the GGBRCB during the meeting in which this body is set up. These items should be prepared by the Green Building Expert, in collaboration with the management of the EC-LEDS Clean Energy Program.

Examples of activities that could be assigned to the temporary executive bureau of the GGBRCB include:

(i.) Maintaining and continuously updating the GGBRCB register of professionals and professional groups.

(ii.) Convening the first substantive Council Meeting of the GGBRCB. This first meeting should include buildings construction professionals, buildings-related representatives of trade craft groups, representatives of professional groups, and representatives of building construction-related SMEs & NGOs. It is also important to engage and invite senior officials of the Tbilisi and Batumi Municipal Councils as well as representatives of the Government of Georgia (GOG). The suggested list of professionals and groups to be invited (presented above) can be expanded and updated over the course of the project.

(iii.) As a result of this first Council Meeting of the substantive GGBRCB, the temporary executive bureau should accomplish the following:

(a.) Formal registration of identified individual stakeholders, professionals, and interest groups. A nominal registration fee (e.g., 5-20 GEL) could initially be established, after consultations between members of the temporary executive bureau of the GGBRCB, the Green Building Expert, and management of the EC-LED Clean Energy Program.

(b.) Obtaining a mandate from the substantive General Council to allow the temporary executive bureau of the GGBRCB to continue to operate for six months. This timeframe should be ample for the temporary executive bureau to complete the foundation programs for the sustainable operations of the GGBRCB – after which the executive operations of the GGBRCB can be transferred to an elected body of GB professionals.

(c.) Creation of two working sub-groups:

i) *GGBRCB Certification Technical Group*, which will have the responsibility of collaborating with the GB Expert to develop the first version of the GGBRCB rating and certification scheme for existing residential and commercial buildings in Georgia; and

ii) *GGBRCB Regulation Technical Group*, which will have the responsibility of collaborating with the GB Expert to develop the GGBRCB rules and regulations governing the operations of the GGBRCB as a whole, drafting regulation governing the training and certification of green buildings assessors in Georgia, identifying the different membership grades of the GGBRCB, and developing the qualifications and criteria for inclusion into each membership grade.

(d.) Establishment of a regular meeting schedule and potential scope of issues to be covered by the board meetings, related to policy, regulatory framework, technical issues, cross-cutting issues, barriers and ways to overcome them for promotion of the GGBCRB.

At the end of this period, the substantive executive bureau of the GGBRCB should create two technical review teams to review the work of the two working sub-groups. At the end of the technical review, the executive bureau of the GGBRCB should arrange for a second meeting of the General Council of the GGBRCB.

3.3.4 Engaging a lawyer and registering the GGBRCB as a corporate organization (NGO or Para-Public Organization) in Georgia

The EC-LEDS Clean Energy Program, in collaboration with the executive bureau of the GGBRCB, should engage the services of an experienced legal practitioner to incorporate the GGBRCB as a legal entity in Georgia.

3.3.5 Carrying out a census of energy consumption ranges for different types of existing residential and non-residential buildings in Tbilisi and Batumi

A census of the range of energy consumption for different types of existing residential and non-residential buildings in Tbilisi and Batumi should be carried out. This will provide baseline energy consumption and GHG emissions data for different types of existing buildings in these two cities.

The data generated from the census would help quantify the potential reductions that can be obtained in energy consumption and GHG emissions in existing residential and non-residential buildings. The census can be carried out in the following three steps:

Step 1: Creation of a Buildings Database

Working with the Green Buildings Expert and a local NGO or university in Tbilisi and Batumi, the management of the EC-LEDS Clean Energy Program should create a database of some existing residential and non-residential buildings in Tbilisi and Batumi. This database should contain unique information for all buildings, including each building's specific address, description of building type, orientation, occupancy density, occupancy, energy types, and energy sources.

Step 2: Development of Sample Data for Residential and Non-Residential Buildings

At the same time that the buildings database in Tbilisi and Batumi is being developed, sample data for selected residential buildings should also be collected. The residential buildings should be grouped into the following categories:

(i.) Multi-floor (more than five floors) residential or mixed-use buildings located within a two kilometer zone from the main commercial hubs of selected administrative units of the two cities. This will address the concern that Tbilisi is not constructed in circular manner;

(ii.) Multi-floor (fewer than five floors) residential or mixed-use buildings located within a two kilometer zone from the main commercial hubs of selected administrative units of the two cities;

(iii.) Multi-floor (more than five floors) residential or mixed-use buildings located about five kilometers from the main commercial hubs of selected administrative units of the two cities;

(iv.) Multi-floor (fewer than five floors) residential or mixed-use buildings located about five kilometers from the main commercial hubs of selected administrative units of the two cities;

(v.) Existing 1-2 floor residential buildings located about five kilometers from the main commercial hubs of selected administrative units of the two cities;

(vi.) Existing single floor residential buildings located within a two-kilometer zone from the main commercial hubs of selected administrative units of the two cities; and

(vii.) Existing single floor residential buildings located about seven kilometers from the main commercial hubs of selected administrative units of the two cities.

Eight to Ten residential buildings should be included in each identified sample sub-group, spread within the sample zone.

In parallel with this activity, sample data for selected non-residential buildings should be collected. These buildings should be grouped into the following categories:

(i.) Multi-floor administrative buildings (e.g., government offices, banks/financial institutions) located within a two kilometer zone from the main commercial hubs of selected administrative units of the two cities;

(ii.) Multi-floor administrative buildings (e.g., government offices, banks/financial institutions) located about five kilometers from the main commercial hubs of selected administrative units of the two cities;

(iii.) Multi-floor shopping blocks located about two kilometers from the main commercial hubs of selected administrative units of the two cities;

(iv.) Multi-floor shopping blocks located about five kilometers from the main commercial hubs of selected administrative units of the two cities;

(v.) Sample of other types of non-residential buildings located beyond five kilometers from the main commercial hubs of selected administrative units of the two cities.

Eight to Ten non-residential buildings should be included in each identified sample sub-group, spread within the sample zone.

Step 3: Level Two Energy Audits for Residential and Non-Residential Buildings

The third step is to carry out Level Two energy audits for five buildings in each category identified above. The average energy consumption data obtained for each category of buildings listed above will form the baseline energy consumption (BEC) for that type of building.

By executing these steps, the EC-LEDS Clean Energy Project team will develop estimates of the baseline energy consumption for residential and non-residential buildings in Tbilisi and Batumi. This same process will enable the team to quantify the GHG emissions attributed to buildings in these two cities. These quantifications will provide the baselines from which reductions in energy consumption as well as GHG emissions can be measured.

A reputable organization that has experience with Level Two energy audits, possibly the Sustainable Development and Policy Center, could be engaged to execute this work for the selected sample of existing residential and non-residential buildings. The suggested timeline for completing this task is six (6) months.

3.3.6 Identification of Pilot EE and GB projects for execution in Tbilisi and Batumi

Upon completion of Step 3, the EC-LEDS Clean Energy Program management team, in collaboration with the executive bureau of the GGBRCB and the Green Buildings Expert, should identify pilot EE upgrade and GB projects for execution in Tbilisi and Batumi. Such pilot projects would provide data on the potential energy reductions and GHG emissions reductions that could be obtained from the implementation of specific EE and GB measures. Such data would then guide decisions related to the expansion of EE in buildings and GB projects in the country.

The Energy Innovation Group, in collaboration with the Tbilisi Municipality, carried out EE upgrade work on an existing multi-story Soviet Era residential building in Tbilisi. Studying the EE actions carried out, as well as data on energy reductions and GHG emissions reductions obtained from this project, could serve as a benchmark for EE upgrade projects in Tbilisi and Batumi on existing multi-floor residential buildings. The EC-LEDS Clean Energy Program should liaise with the Energy Innovation Group to collect all documents related to the implemented EE upgrade program, in order to obtain complete data on all of the EE measures implemented under this scheme.

The EC-LEDS Clean Energy Program EE pilot projects should also target EE measures that were not implemented in the Energy Innovation Group's project—e.g., replacement of metal doors with double glazed PVC doors, and replacement of existing lightings with energy efficient lighting units.

One GB concept not implemented in the Energy Innovation Group's project, but which should be implemented in the EC-LEDS Clean Energy Program EE pilot project, is the re-use of all discarded construction materials (e.g., concrete, wood, glass) which originated from the EE upgrade of the existing building being updated.

3.3.7 Employment of an Administrative Assistant focusing on GGBRCB activities

Once the GGBRCB and the two Working Subgroups have been established, the GGBRCB may decide to hire an Administrative Assistant for working directly under the supervision of the Chair of the temporary executive bureau of the GGBRCB. The Administrative Assistant would provide secretariat, administrative, and co-ordination functions for the GGBRCB. All incoming communications, coordination, and technical input relating to the work of the temporary executive bureau of the GGBRCB and two Working Subgroups, and all other issues relating to the functioning and operations of the GGBRCB would be handled by this individual.

3.3.8 Publicity campaigns

Publicity campaigns about the Green Buildings activities—to be carried out under the EC-LEDS Clean Energy Program public awareness component—should commence as soon as the temporary executive bureau of the GGBRCB is in place. Media outlets for the publicity campaign should include posters, brochures/leaflets, radio, and television.

3.3.9 Creating and maintaining liaison with the Municipalities of Tbilisi and Batumi

Large cities are major sources of GHG emissions. Since 2010, six cities in Georgia— Tbilisi, Batumi, Gori, Kutaisi, Rustavi and Zugdidi—have joined the Covenant of Mayors. As a result of joining this covenant and elaborating Sustainable Energy Action Plans (SEAPs), these cities began to work on the projects and measures that will enable them to become "low carbon cities" by 2020. Tbilisi aims to reduce its overall CO_2 emissions by 24% by the year 2020.

Creating and maintaining a good relationship with the municipalities of Tbilisi and Batumi is an important activity that should continue during the entire project lifespan. Benefits will include:

(i.) Ensuring that the municipalities of Tbilisi and Batumi are on board with the idea of setting up the GGBRCB. Many existing buildings in Tbilisi and Batumi are owned or managed by these Municipalities and it is important to include this building stock in the GB scheme.

(ii.) Enhancing synergy between the EC-LEDS Clean Energy Program and the two municipalities so that collaborations can be developed between the EC-LEDS Clean Energy Program and other programs for achieving GHG emissions reductions in which these municipalities are also involved.

(iv.) Providing carbon accounting opportunities for publicly owned existing buildings that are controlled by the Tbilisi and Batumi municipalities.

(v.) Ensuring the integration of the GB program into the construction permitting process in these two cities.

3.3.10 Liaising with other international organizations to ensure synergy in the areas of EE and GHG emissions reduction

During consultations with the EU delegation in Georgia, it became apparent that some activities of the EU delegation have similar objectives to those of the EC-LEDS Clean Energy Program. One example is the EU delegation's intended pilot project to quantify the amount of energy used in existing buildings in Georgia by implementing an EE upgrade program for some existing buildings – similar to the objective of the EC-LEDS Clean Energy Program. During the consultation, both organizations agreed to collaborate in the execution of such activities.

It is recommended that the EC-LEDS Clean Energy Program explore the possibility of collaborating with other internationally funded EE, renewable energy, or GB related projects planned for execution in Georgia. Organizations that could be contacted for discussions in this regard include:

(i.) Implementers of other USAID funded projects in Georgia;
(ii.) The EU/INOGATE program, which is working on EE in buildings as well as financing partial grants for the implementation of pilot building EE projects; and
(iii.) Millennium Challenge Account (MCA) – Georgia, which is planning to execute EE upgrades for existing buildings in Georgia with funding from the Millennium Challenge Corporation (MCC).

3.3.11 Liaising with the Government of Georgia to provide input to the Building Construction Code

The EC-LEDS Clean Energy Program, in collaboration with the executive bureau of the GGBRCB, should develop effective liaison opportunities with the GOG. This will generate avenues for the EC-LEDS Clean Energy Program and the GGBRCB to deliver input into different GOG policy instruments that relate directly to the output for Component 2 of the EC-LEDS Clean Energy Program.

For example, the EC-LEDS Clean Energy Program should communicate with the GOG to ensure that Dr. Karine Melikidze, Director of the Sustainable Development and Policy Centre (SDAP-Centre), and the GB Expert of the Alliance to Save Energy have an opportunity to provide relevant input relating to EE, RET solutions, and GBs into the proposed GOG construction code.

The draft version of the GOG construction code contains subsections that refer to EE and the application of renewable energy technologies in buildings. These subsections in the construction code still need to be expanded. Creating mechanisms by which the EC-LEDS Clean Energy Program can provide such input into the construction code would result in the following advantages to the program:

(i.) Further strengthen the relationship between the EC-LEDS program and the GOG.
(ii.) Create the potential for wider application of GB concepts in Georgia through the integration of GB concepts into the Georgian construction

code. Once legislative approval for the construction code has been received, some GB components will become law in Georgia, significantly enhancing both GB practices and GHG emissions reductions.

(iii.) Increased engagement with the GOG will accelerate the market for GB and GB construction materials in Georgia.

3.3.12 Collaborating with financial institutions in Georgia to design and package financial portfolio for GB in the country

Implementing GB concepts in building construction and/or the use of GB construction materials tends to be more expensive than constructing buildings using traditional practices. The EC-LEDS Clean Energy Program should consider collaborating with financial institutions in Georgia—e.g., TBC Bank and other banks—to develop customized financial incentives for stakeholders in the green buildings industry, such as developers and traders in green buildings construction materials.

Banks normally have loan portfolios specifically packaged for financing different schemes, such as large scale trading, manufacturing, or building construction. The collaboration between local Georgian banks and the EC-LEDS Clean Energy Program could focus on developing a specialized financial portfolio for financing green building construction or trading in green buildings construction materials. Financial incentives such as better lending terms, lower interest rates, and tax breaks for green buildings construction and traders in green buildings construction materials will help drive GB concepts and practice in Georgia.

The EC-LEDS Clean Energy Program would not directly provide the finance, green buildings incentives, or directly package the financial program. The EC-LEDS Clean Energy Program would provide information on GB and EE measures and technologies to the local Georgian banks, and the banks would use this information to prepare financial portfolios customized for the green building industry in Georgia.

The EC-LEDS Clean Energy Program could also collaborate on this activity with international financial bodies, such as the European Bank for Reconstruction and Development (EBRD) and the German Development Bank, KfW.

- EBRD's activities in Georgia focus primarily on addressing critical bottlenecks to local private sector investment and foreign direct investment by engaging through the Eastern European Energy Efficiency and Environment Partnership (E5P) Foundation to provide access to funds for EE interventions. The major portion of funds is provided through loans, although EBRD also provides some grants. The EC-LEDS Clean Energy Program could collaborate with EBRD to extend its financing programs to cover green buildings and green building construction materials.

- The German Development Bank, KfW, acts on behalf of the German Government. In November 2012, KfW signed a loan agreement with the holding company JSC Bank of Georgia, totaling EUR 25 million within the framework of KfW's Renewable Energies Programme. KfW is planning to consider a soft loan to the Government for EE interventions. This could be extended to cover green buildings construction and traders in green buildings construction materials.

SECTION FOUR: APPROACH TO DEVELOPING A MONITORING, REPORTING AND VERIFICATION (MRV) FRAMEWORK.

4.1 Suggested Approach for Developing a MRV Framework for Georgia

The suggested approach for developing an MRV framework for Georgia is to:

a) Adopt a management structure for the GGBRCB. This would be the main body responsible for verifying energy savings and quantifying GHG emissions reductions, as well as all other operations for the buildings rating and certification scheme in Georgia.

b) Use a specially developed computer software package as the analysis tool in the Georgian buildings rating and certification scheme. The special computer software would serve as the main structure for monitoring and reporting energy savings and GHG emissions reduction for the buildings rating and certification scheme in Georgia

c) Developing a life-cycle assessment tool for the GGBRCB. This tool would be used to assess a building's compliance with the selected GB parameters which are included in the different versions of the Georgian green buildings rating and certification scheme.

4.2 Proposed management structure for the GGBRCB

The proposed management structure for the GGBRCB consists of three levels:

(a.) The Council
(b.) The GB Management Unit
(c.) The Accreditation and Certification Organ and the Regulation and Standards Organ

4.2.1 The Council

The Council would be formed of individual professionals and representatives of buildings-related professional bodies. The Council would serve as the GB working group and would be the highest decision making body of the GGBRCB.

4.2.2 The GB Management Unit

The GB Management Unit would be the next level in the structure for the GGBRCB. From the Council, members with appropriate skills, experience, and training would be elected into the GB Management Unit. This unit would constitute the main technical body for the Georgian rating and certification scheme.

The Council would elect 50% of the members of the GB Management Unit, while the other 50% would be constituted of appointed members, who serve specific roles based on their technical competence. The GB Management Unit in itself would oversee two technical bodies: the Accreditation and Certification Organ and the Regulation and Standards Organ.

4.2.3 The Organs

The main duties of the *Accreditation and Certification Organ* would be 1) the accreditation of Assessors for the scheme, and 2) the certification of assessed buildings and issuance of GB ratings certificates.

The accreditation duties of this organ would include management and maintenance/updating of the electronic database (register) of assessed buildings in Georgia. This organ would also manage the pool of highly skilled Verifiers who cross-check the work of Assessors that carry out the field assessment and ratings of buildings in Georgia.

The responsibilities of the *Regulation and Standards Organ* would include: 1) the development and enforcement of the rules and regulations governing the Georgian green buildings scheme, and 2) maintenance of the standards for the Georgian scheme.
Under its regulation duties, this organ would also be responsible for the management and updating of the various membership grades under the Georgian scheme. Membership grades may include:

(a.) Fellow and Verifier;
(b.) Member and Assessor;
(c.) Associate and Assessor; and
(d.) Affiliate and Trainee Assessor.

Attainment of these grades would be based on academic and professional qualifications, years of field experience, and expert skills.

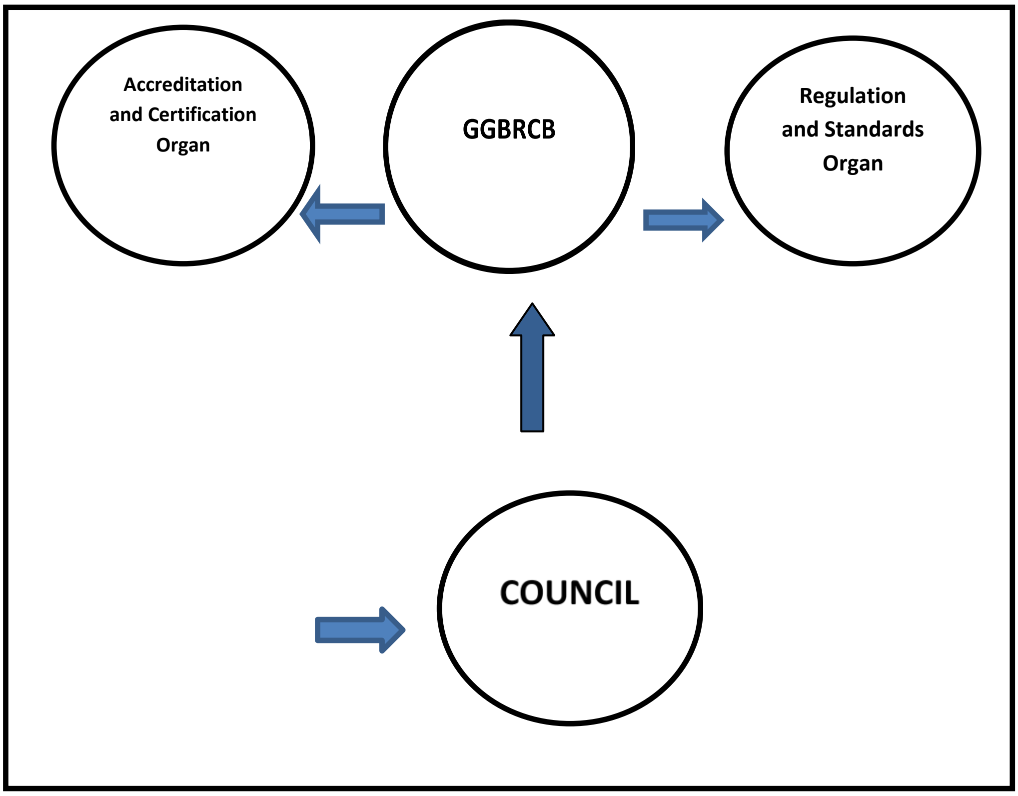

Figure 21: Proposed management structure for the GGBRCB

4.3 Verifiers and Assessors for the Georgian Scheme

The Verifiers for the Georgian GB rating and certification scheme would be highly skilled professionals who have received training in the data verification and building rating procedures for the Georgian GB rating and certification scheme.

Georgia already has a pool of qualified professionals such as building physicists, energy consultants, and energy efficiency engineers who can be trained to serve as Assessors (in the field) and Verifiers for the Georgian green buildings rating and certification scheme. This scheme would provide tools for systematically quantifying baseline and reduced energy use and GHG emissions from existing buildings in Georgia – as well as for measuring and documenting improvements in all of the other GB parameters selected to be part of the Georgian GB rating and certification scheme.

For new construction, the rating and certification scheme would involve development and use of a life-cycle assessment (LCA) methodology with which to assess the GB parameters selected for inclusion in the residential, non-residential, and public buildings versions of the scheme. A point system would be developed under which buildings would score points for each of the preselected GB parameters. The number of points which a building scores would determine the level of its rating (i.e., its GB credentials). Certified Assessors would serve as the main contact point and field agents for measuring and reporting the buildings' GB scores. After the Assessors performed their assessments, Verifiers would be responsible for confirming and recording the GB scores.

For new construction, both Assessors and Verifiers would undergo training and testing to ensure proficiency in:

(a.) use of the LCA methodology;
(b.) use of the scoring systems for all the preselected GB parameters for the different versions of the Georgian GB rating and certification scheme; and
(c.) use of the point system for assessing, rating, and certifying buildings in the Georgian GB rating and certification scheme.

Higher academic and professional attainment, as well as years of field experience, would differentiate Verifiers from Assessors.

4.3.1 Identification and Training of Verifiers and Assessors

The training and accreditation of Verifiers would be carried out by the GGBRCB. To be accepted as a Verifier for the Georgian scheme, an individual would need to have at least a Master's Degree in a physical science or an engineering discipline, with at least fifteen years of work experience. The individual would then need to undergo training and testing on the following:

(a.) carrying out energy audits in buildings;
(b.) using the specialized GB software;
(c.) using the LCA methodology; and
(d.) identifying appropriate EE and RET solutions for both existing and new buildings.

Verifier candidates also will need to compile a portfolio of sample energy audit work executed as part of the training process.

To be accepted as an Assessor for the Georgian scheme, an individual would need to have at least a university/Bachelor's degree in a physical science or an engineering discipline, with at least two years of work experience. The individual would then undergo similar training and testing as indicated for Verifiers above; separate training sessions may be provided for Assessors of existing buildings (including the specialized software module) and Assessors of new buildings (including the LCA methodology).

The Assessors would work as contract staff of the GGBRCB. Assessors would be the field staff who would visit client sites and assess buildings. They would obtain data, input and run the data through the specialist software, and obtain the certification results (for existing buildings). Through this process, the Assessors would serve as the first level for monitoring, recording, reporting, and verifying of GHG data for Georgia.

4.3.2 Specialized Software Computer Program for the Georgian Scheme

The proposed Georgian GB rating and certification scheme should fully satisfy the requirements of the European Union Energy Performance of Buildings Directive (EPBD).

There are two main routes for rating and certifying buildings under the different existing green buildings rating and certification schemes. One route utilizes skilled professionals to carry out the rating and certification process; e.g., LEED utilizes LEED APs and BREEAM utilizes BREEAM APs to perform this function. The second route utilizes specialized computer software programs to carry out analysis of data obtained by skilled Assessors. BREEAM utilizes this methodology for rating and certifying existing buildings.

The different computer software programs used for the analysis of building information and operational data are tools for quantifying GHGs that originate from existing building operations as well as analyzing the environmental impact of existing buildings.

One recommended option would be for the EC-LEDS Clean Energy Program to contact the company that developed the DesignBuilder software to tailor a version of the software specifically for Georgia. Preferably, however, a new software program could be developed specifically for the Georgian green buildings scheme. The EC-LEDS Clean Energy Program could collaborate with Georgian IT experts and building engineers to develop a similar software program, uniquely for use in the GGBRCB.

Upon completion of the building assessment process, all building information relating to energy consumption would be logged into the computer software by the Assessor. The software would carry out analysis to determine the GHG emissions and other GB parameter measurements attributed to the specific building, and would generate the building's rating as well as recommendations which, if implemented, would improve the initial rating.

The utilization of specialized software would constitute the main process by which the GHG emissions attributed to the occupancy and operations of all existing buildings would be measured, recorded, and reported in the Georgian green buildings rating and certification scheme.

The GGBRCB would also maintain an online database of the ratings of existing buildings. This would be accessible to members of the public and would also serve as a marketing tool for real estate agents.

ANNEX 1. GLOBAL GREEN BUILDING RATING SCHEMES

	COUNTRY	REGION	GREEN BUILDINGS CERTIFICATION SCHEME
1.	Australia	Australasia	Nabers / Green Star / BASIX
2.	Brazil	South America	Aqua / LEED Brazil**
3	Canada	North America	LEED Canada / Green Globes / Built Green Canada**
4.	China	Asia	GBAS
5.	Czech Republic	Europe	SBTooLCZ‡
6.	Finland	Europe	PromisE
7.	France	Europe	HQE
8.	Holland	Europe	BREEAM Holland*
9.	Hong Kong	Asia	BEAM*
10.	India	Asia	Indian GB Council / GB Construction India / GRIHA†
11.	Indonesia	Asia	GBC Indonesia / Greenship†
12.	Italy	Europe	Protocollo Itaca / GBC Italia†
13.	Japan	Asia	CASBEE
14.	Jordan	Middle East	Jordan GBC†
15.	Malaysia	Asia	GB Institute Malaysia†
16.	Mexico	South America	LEED Mexico**
17.	New Zealand	Australasia	Green Star NZ
18.	Pakistan	Asia	Pakistan GBC†
19.	Philippines	Asia	BERDE / Philippines GBC†
20.	Portugal	Europe	Lider A / SBTooLPT‡
21.	Qatar	Middle East	Sustainability Assessment System (QSAS)
22.	Singapore	Asia	Green Mark
23.	South Africa	Africa	Green Star SA
24.	South Korea	Asia	GB Certification / Korea GBC†
25.	Spain	Europe	VERDE
26.	Switzerland	Europe	Minergie
27.	Taiwan	Asia	LEED / GB Label**
28.	Thailand	Asia	TREES
29.	Turkey	Europe	CEDBIK
30.	United Arab Emirates	Middle East	Estidama
31.	United Kingdom	Europe	BREEAM*
32.	United States	North America	LEED / Living Building Challenge / Green Globes / Build it Green / NAHB NGBS / International Green Construction Code (IGCC) / ENERGY STAR**
33.	Vietnam	Asia	LOTUS Rating Tools

Source: "Reducing Environmental Impact." [3]

SYMBOL	EXPLANATION
*	BREEAM and BREEAM-related green building schemes
**	LEED and LEED-related green building schemes
†	National Green Building Council and GBC-related schemes
‡	SBTooL and SBTooL-related green building schemes
	Nationalized green building schemes

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